ELECTRICAL REVIEW

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A New Circuit Breaker.

The accompanying cuts illustrate the new automatic circuit breaker, or safety cut-out, manufactured by the Schuyler Electric Company, of Middletown, Conn. This valuable appliance was invented by Mr. C. G. Young, superintendent of the Mount Morris Electric Light Company, N. Y., and afterwards worked up to its present practical and useful form by Messrs. Dalzell and Shepard, of the Schuyler Company. It is controlled by the Royal Electrical Specialty Company, of New York City.

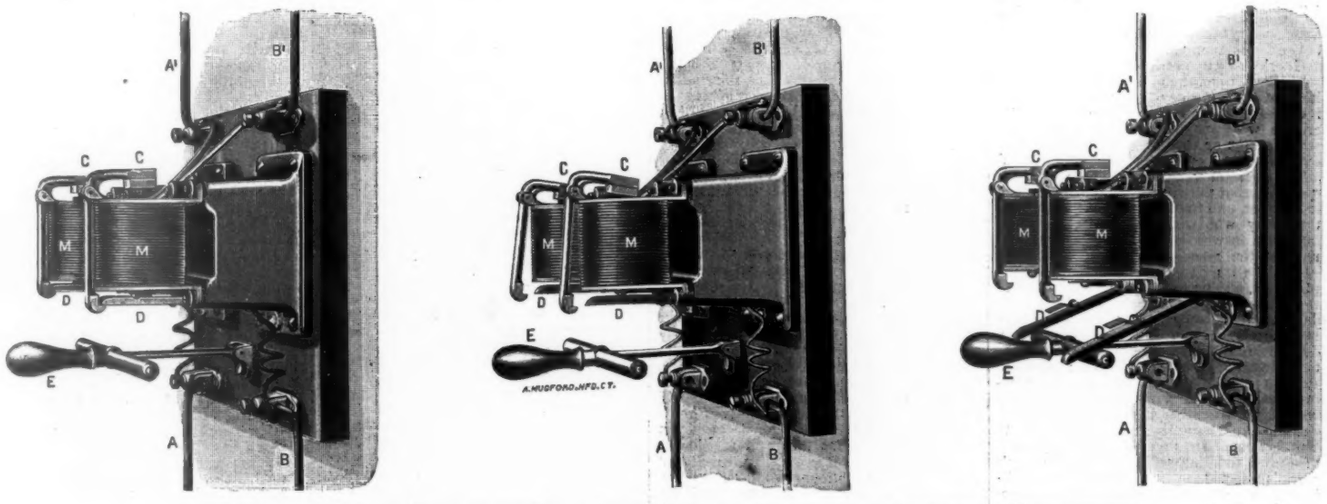
The liability of breaks occurring on live wires, and the necessity that often arises in large cities in case of fire, to cut electric light wires, to facilitate the movements of the firemen, has created a demand for something that under such circumstances will render the subtle current perfectly harmless to those who are obliged to come in contact with the wires.

The path of the current is from the dynamo terminals to binding post A^1, to magnet M, then through breaking lever to binding post A, to line, to binding post B, breaking lever D and magnet M, to binding post B^1, to dynamo, thus completing the circuit.

Should the line be cut or broken for any reason, the magnets $M\,M$ become instantly demagnetized and the levers $D\,D$ drop from contact with the bobbins, thus automatically, instantly and absolutely, disconnecting the lines, as shown in Fig. 3. Before again closing the circuit breaker, which is done by raising both levers with circuit closer E, the dynamo attendant should discover what has caused the trouble, and not close the breaker until the difficulty has been found and remedied.

Where several dynamos are in one station, the circuit breakers can be attached to an annunciator, so that the attendant may instantly be informed on which line the trouble exists and take immediate steps to correct it.

The desirability of this apparatus in all large stations, and especially in cities, can be readily seen, and it is sure to become quite popular.



Figs. 1, 2 and 3.—Three Views of the Young Automatic Safety Cut-Out.—Schuyler Company, Manufacturers.

Fig. 1 represents the circuit breaker in position previous to the starting of dynamo. Fig. 2 is after the current has been turned on; while Fig. 3 shows the circuit breaker as it would appear should the line be cut or broken while the current is on.

The circuit breaker is composed of two single electro-magnets, $M\,M$, the bobbins of which are of metal. One end of the wire with which the magnets are wound is permanently connected to the metal bobbin, while the free or outside wire is carried to the binding posts A^1 and B^1; the circuit breaking levers $D\,D$ make a contact on the bottom of the magnets $M\,M$, and are held in position until current is started, by automatic latches $C\,C$. A flexible cable connects levers $D\,D$ with binding posts A and B. The dynamo terminals are connected to binding posts A^1 and B^1 and the line to A and B.

The circuit breaker being in position, as shown in Fig. 1, is ready for dynamo to be started. As soon as current is generated by the dynamo, the armatures of the latches $C\,C$ are drawn to the electro-magnets $M\,M$, thus leaving breaking levers $D\,D$ free; they now being held in place by the magnets $M\,M$, as shown in Fig. 2.

The First Electric Light Station.

To the Editor of Electrical Review:

I noticed in a recent issue of the Review, a query from a subscriber who desired to know by whom and where the first electric light plant was installed in this country. I think it would be rather difficult for any one to reply positively to this inquiry, since small dynamo machines with clock-work lamps, etc., were in use in some of the colleges and laboratories many years ago. Arc lights were exhibited at the Centennial Exhibition at Philadelphia, in 1876.

I can answer the question definitely as regards series arc lighting. The first exhibition of the series system of arc lighting was made by the Telegraph Supply Company, of Cleveland, Ohio, to whose business the Brush Electric Company succeeded, at the American Institute Fair in New York, which opened Sept. 11, 1878. At that fair a Brush dynamo ran several Brush series arc lamps successfully, and lighted a part of the building. It may interest later day enthusiasts to know that in this installation the circuit was formed of bare copper wire attached to the wood-work of the building by ordinary metallic staples. During the fall of 1878, a number of Brush plants of series arc lights were installed in New England and elsewhere.

Very truly yours,

Fred H. Whipple.

Detroit, Mich., Jan. 20, 1890.

The Illinois Electric Lighting Association.

A meeting of the representatives of central station companies, called for the purpose of organizing a State Association, was held in the rooms of the Chicago Electric Club, Saturday, January 18th.

The objects of the movement having been fully discussed, it was resolved to effect the organization at once. This was done by the adoption of a Constitution and the election of the following officers:

President, C. H. Wilmerding, secretary and treasurer Chicago Arc Light and Power Company.

First vice-president, A. L. Ide, president Springfield Electric Light and Power Company; second vice-president, Douglass Hapeman, secretary and treasurer Ottawa Electric Light and Power Company.

Secretary and treasurer, Chas. E. Gregory, Sun Electric Light Company, Chicago.

Executive committee: C. H. Wilmerding, Chicago; A. L. Ide, Springfield; Douglass Hapeman, Ottawa; Chas. T. Page, Englewood, and M. A. Beal, Rockford.

Mr. Page is secretary and treasurer of the Englewood Electric Light Company. Mr. Beal is secretary and treasurer of the Forrest City Electric Light and Power Company, at Rockford.

A resolution was passed directing the secretary to have the Constitution printed, also blank form of application for membership, and a form to secure sundry items of data, and send copies of the same to every company, firm or person in the State eligible to membership, with a letter inviting them to become members of the association as organized. It is expected that this association will develop into one of the largest State Associations in the country. There is a sufficient number of local companies in that State to supply the material.

Interesting Figures.

Whipple's Electrical Report for January, shows that the total number of central electric light stations in the United States is 1,265. The total number of gas companies is 981, and of these 237 operate electric light plants in conjunction with their gas business. The number of electric railways in this country is 162.

Michigan Electric Light Association—Seventh State Organized.

A meeting of the companies doing business in the State of Michigan, was held at the office of the Brush Electric Light Company, Detroit, January 17, for the purpose of organizing a State Association.

The attendance and the response from companies throughout the State was good. The desirability of organizing such an association was agreed to without dissent.

The association organized by adopting By-laws and electing the following officers:

President, Geo. Peck, president Edison Illuminating Company, Detroit.

Vice-president, James R. Dee, general manager Peninsular Electric Light and Power Company, of Houghton and Hancock.

Secretary and treasurer, Jos. E. Lockwood, general manager Brush Electric Light Company, Detroit.

Executive committee, George Peck, Detroit; James R. Dee, Houghton; Jos. E. Lockwood, Detroit; W. H. Powers, Grand Rapids.

One vacancy was left to be filled after the filing of membership applications.

The secretary was directed to send a copy of the By-Laws and a blank application for membership to every company in the State.

The association will give its first attention to the establishing of a general system of rules and regulations for the wiring of buildings, so as to secure the safest and best construction and service.

Storage Batteries in Philadelphia.

The Pennsylvania Railroad Company, having decided to increase the capacity of the electric lighting plant at their main offices in Fourth street, Philadelphia, have shifted their storage batteries to other commodious quarters in the forward part of the building, in order to utilize the old battery room in the rear for a Corliss engine, to be used as an auxiliary to their present power plant. The Electro-Dynamic Company has been awarded the contract for making the necessary alterations in the battery plant, switches, wiring, etc. The system will be changed from 60 to 100 volts, the present capacity of the plant being about trebled. The original wiring by the Electro-Dynamic Company, for 1,200 lights, is ample for the additional requirements.

A REVIEW OF MODERN ELECTRICAL THEORIES.

BY PROFESSOR WM. A. ANTHONY, BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, JANUARY 21, 1890.

The general phenomena of electricity are familiar to us all. As children we learned of the attraction and repulsion of electrostatic charges, of condensers, of insulators and conductors, of electric currents and electro-magnets, of telegraphs, and electric fire alarms and electric bells, of the heating of conductors, and even electric lights. We have long been familiar with the effect of the current on a magnetic needle, and with the attraction and repulsion of currents for each other. We have seen that these effects are manifested at a distance from the conductors which carry the currents and we have been willing to believe that the distances at which these phenomena could be recognized were limited only by the want of sensitiveness of the apparatus through which the effects were manifested. Probably not many of us stop to think *how* these effects were brought about. We were content with a general statement of the relations of the phenomena, or, at least, with the determination of the direction and intensity of the forces due to a given confirmation of current. We talked of the attractions and repulsions as action across space, and, if we thought of them at all as requiring any mechanism through which to act, we still felt satisfied when we had discovered and formulated the laws that govern the action of these forces.

It did not matter to us that attraction across empty space was unthinkable; it was enough that action took place, and that we could measure and, to a certain extent, control it. We constructed instruments and computed forces acting under certain conditions; we multiplied experiments and thought we had developed a vast science. But there have not been wanting, even among the earlier philosophers, some who could not feel satisfied with the idea of action at a distance. Experience gives no clue to any explanation of action of one body upon another at a distance, except through some intervening mechanism, and if we find cases where such intervening mechanism is not apparent, to say that in these cases action at a distance is taking place, is only to say that the action is unexplained.

Gravity acts upon the distant planets, and, we believe, upon the most distant stars; but it is not enough to say that gravity acts, that it decreases as the square of the distance increases, we want to know *how* it acts. By what means or though what medium does our earth reach out to the distant planets and affect their movements? These are the questions that the dissatisfied few have asked in the past, and to-day it is not the few but the many who would be glad to have the questions answered. Faraday early taught us that the mere statement of the law of electrical attraction or repulsion was no explanation, and he sought the explanation in the action in the intervening medium. He demonstrated, by experiments that have become classic, that the effect of induction depends upon the nature of the medium intervening between the conductors; a demonstration that here, at least, the intervening medium took part in the action and helped to determine the result. Magnetic and electro-magnetic phenomena were to Faraday also effects propagated through the medium; and Maxwell, following Faraday's work, subjected the whole matter to a searching mathematical analysis. It was necessary, in order to complete the theory, to assume the existence of a medium in which the forces were exerted; but, as a medium had already been assumed to account for the phenomena of light, it would hardly be scientific to assume another to account for electrical phenomena. But would not one medium suffice for electrical and optical phenomena as well? Maxwell showed how the question of the identity of the two media could be tested, and our modern views of electricity are mainly the results of his work. What do we *know* of electrical phenomena? We know that pieces of glass and silk rubbed together and then separated attract each other; that the property of attraction can be imparted to metals if they are insulated; that if two such masses of metal be connected by a wire the power of attracting each other disappears, and, at the same time, the wire is warmed, and for an instant exerts magnetic forces at right angles with the wire. Numerous other facts we know, but these will suffice as illustrations of the phenomena. When a metal conductor is discharged by touching it with a wire, we say the wire carries a current, and we have been accustomed to ascribe the heating and the magnetic effects to that current. We have looked upon the thing, whatever it is, that takes place in the wire, as the origin of all that takes place around it. The current warms the wire, and it confers upon it the property of acting upon magnetic needles; but *how* does it act? We cannot conceive of the action of that wire on that needle, except through something extending from the wire to the needle through which the wire can exert a push or pull. All around that wire the needle is affected; at considerable distances the effect can be exhibited, and we believe it is only want of delicacy of our apparatus that prevents our discovering it at the greatest distances. If the wire acts it acts through a medium in which it creates a disturbance, and the disturbance in turn acts upon the magnetic needle. But are we sure that the action begins with the wire? Is it not possible that the action begins in the medium, and that the wire merely separates portions of the medium and so permits action that could not otherwise take place? Maxwell has proposed a mechanical illustration of the action taking place in space when electrical phenomena occur, and Fleming and Lodge have elaborated it and brought it within the reach of non-mathematical readers. Let us suppose all space to be filled with wheels connected by idle wheels in such a way that when one turns all must turn in the same direction, except that the elasticity of the system permits a small movement of one wheel before the others in the vicinity begin to move. Electro-motive force is then something that tends to turn the

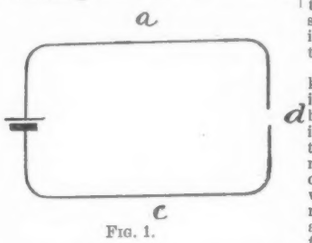


FIG. 1.

wheels. Let *b* in Fig. 1 represent some source of electro motive force; *a* and *c* conductors not forming a closed circuit but having an opening at *d*. The electro-motive force at *b* tends to turn the wheels, but so long as the gap exists at *d* the wheels are connected through all space, and the E. M. F. at *b* can effect nothing except to turn the wheels through a small angle until the elastic resistance balances the E. M. F. In the conductor the wheels are not supposed to be rigidly connected. They can turn by slipping on each other, and the wheels in space may turn by slipping on the wheels in the conductor; hence, as the ends of *a* and *c* approach each other, the connection between the wheels within the enclosure and those of outside space becomes smaller and smaller, and, when the conductors touch, there is no longer anything to prevent the wheels within from turning, and they begin to spin, in obedience to the E. M. F. at *b*. The conductor is heated by the friction due to the slip of the wheels around and within it. The spinning of the wheels constitutes the magnetic forces, if we assume the wheels, originally spherical, to become flattened spheroids by the spinning, and to be forced to remain in contact at their poles. Assume the wheels to have inertia, and it will require time for them to reach their full velocity, and the time will be greater as the number of wheels is greater, that is, as the magnetic forces developed are greater. On the other hand, the wheels will not at once stop if the electro-motive force is removed, and if the conductor be broken at some point, allowing the rapidly spinning wheels enclosed by it to come in gear at that point with the stationary outside wheels, there will be, for a brief time, until the moving wheels can be brought to rest, a clashing and disruptive action known as the extra spark.

I have spoken of the heating of the conductor as due simply to the friction of the spinning wheels upon the wheels within the conductor. The greater the friction, the greater the motion imparted to the wheels within the conductors, and the greater the heating. The less the friction, the less the heat, and if there were a substance whose wheels could revolve among themselves and against the wheels of space without friction, such substance would form a perfect conductor which would offer no resistance to the motion of the wheels in the space enclosed by it, and however rapidly those wheels might revolve, they would have no influence to produce motion within such a conductor. We are led, then, to this, that a perfect conductor, instead of being a substance in which any E. M. F. produces an infinite flow of electricity, may be a substance in which no effect whatever is produced.

I do not present this as representing the real activities involved in electrical phenomena, or as a theory by which all electrical phenomena may be explained. I give it as bringing prominently into view the activities in the medium surrounding the conductor; whereas, the language in which we usually describe electrical phenomena points to the conductor itself as the seat of the electrical forces. Whatever our theory, we know that something does take place in the medium that surrounds the conductor. We know that were a heavy current to flow through a conductor in the most distant part of this room, a delicate needle here on the table would show that a magnetic field was produced here. We are certain that magnetic lines of force from the electric currents on our streets, whether overhead or underground, permeate this room and traverse our bodies even, though we have no sense through which we can become directly conscious of them. Take in your hands two wires connected to the poles of a battery or dynamo and touch their ends together. You see a flash of light, the wires become warm, they attract iron filings; coiled into a spiral they will attract with great force large masses of iron; two such spirals will attract or repel one another. What more natural than to say, Here in the wire is a new activity which warms it and confers upon it magnetic properties? What more natural than to forget or fail altogether to recognize the activities in the space around; activities that do not impress any of our senses; that do not wrench our arms, or burn our flesh, or blind our eyes; and yet it is well to fix our attention for a while upon the space that the conductor encloses, and recognize the fact which the little delicate needle demonstrates to us, that something is going on in that space, something quite as important, perhaps more important, than that which takes place in the conductor.

Whatever the magnetic forces are, we know they cannot be called into existence instantaneously. Time must always elapse before the full effect of an electric current is felt, and the greater the forces developed the longer are they in reaching the maximum. Moreover, the current in the wire cannot be at once developed; it keeps pace with the magnetic force and reaches a maximum only when the magnetic forces reach a maximum. This is exactly what would follow if magnetic forces result from the setting in motion of wheels possessing inertia. Whatever magnetic forces may be, they begin and end like the motions of massive bodies.

Continuing our hypothesis, an electro motive force would be anything that tends to set the wheels in motion. The wheels are set in motion if a limited number acted upon by the E. M. F. are separated by a conductor from the other wheels of space; but, even if they are not separated, that is, if the conductor does not form a closed circuit, the wheels are rotated through a small angle depending on the elasticity of the wheel work. This displacement constitutes an electric charge, the tendency of the wheel work to spring back is *difference of potential*, and this difference of potential is maintained by the E. M. F. Here allow me to call attention to the distinction between difference of potential and E. M F. I often see statements that indicate that the distinction is not clearly kept in view. In that excellent little volume, the Dictionary of Electrical Terms, the statement occurs that electro-motive force is *due* to difference of potential. It should rather be difference of potential is due to E. M. F. Difference of potential is *an* electro-motive force, but not all electro-motive forces are difference of potential; and, furthermore, I can think of no case of difference of potential that does not owe its existence to some other electro-motive force, not difference of potential Difference of potential is a moving force acting from within. Electro-motive force acts from without. Difference of potential results from a changed electrical distribution, an electric strain, and represents the tendency to return to the state of equilibrium. Electro-motive force is the something from without that produced the electric strain. Consider our wheel work illustration. I may seize a wheel here and turn it, but I can only turn it through a small angle before the elastic forces, brought into play by the distortion, balance the force that I am able to exert. My force is electro-motive force, the elastic forces are difference of potential.

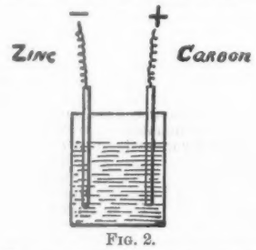


FIG. 2.

Let Fig. 2 represent a voltaic cell with its copper and zinc plates and dilute acid; we know that something takes place by which the copper becomes positive and the zinc negative, and, if the copper and zinc be joined by a wire, electricity is said to flow from the copper to the zinc through the wire, and from zinc to copper through the liquid. The flow through the liquid used to be explained by assuming the zinc to be positive and the copper negative within the liquid; just the reverse of what we find without. But connect the copper to the zinc by a wire under the liquid, the current flows through the wire from the copper to the zinc. The copper, therefore, is not negative, but everywhere positive. Then why does the current set from the zinc to the copper through the liquid? Because there is an electro-motive force, not difference of potential, mind you, for the difference of potential tends to cause a flow the other way, but a something that forces the current through the liquid against the electric pressure. The cell is an electric pump that pumps electricity from the zinc into the copper until the pressure becomes so great that the pump stops. Open a passage from the copper to the zinc by connecting the two by means of a metallic wire, the electricity flows and relieves the pressure, the pump begins to work and so maintains a continuous flow. No; E. M. F. is not difference of potential, although difference of potential is E. M. F. It is even possible to produce an electric current without any difference of potential whatever in any part of the circuit, just as it is possible to produce a flow of fluid without any difference of pressure.

Whatever difference of potential may be, it behaves like a force developed by an elastic displacement in a solid body. Whatever magnetic forces may be, they behave as though produced by the motions of inert masses. An electro-motive force, suddenly brought to bear at a given point, has to overcome not only the elastic force but the magnetic inertia. In other words, an electro-motive force, tending to produce current, immediately develops a difference of potential against which it must act, and also develops magnetic forces which retard its action; so a *fluid-moving force* meets opposition in the elastic force of the fluid and in the inertia of its particles. But the effect of any such force is propagated through the medium with a finite velocity expressed by the well known formula,

$$V = \sqrt{\frac{E}{D}}.$$

Electric displacements ought, therefore, to be propagated with a finite velocity which should have some relation to the ratio between the electro-static effects, analogous to elastic displacements, and the electro-magnetic effects analogous to the effects of moving masses. You all know that it is shown that this velocity is expressed by the ratio of the magnitudes of the electro-magnetic and electro-static units quantity, and you know also that determinations of this ratio show it to be the velocity of light. This determination gave a very strong support to Maxwell's electro-magnetic theory of light, and coupled with the fact that observations, so far as they went, indicated that magnetic effects are propagated from the sun to the earth with the same velocity as light, made the theory at least extremely plausible. But within two years the wonderful experiments of Hertz have demonstrated beyond question that electro-magnetic waves travel through space from every source of alternating currents or potentials, and that the waves travel with the velocity of light. In this city there are, I suppose, many alternating current systems. When we think of these in action, we are apt to think only of the activity in the conductors of the machines, the lines, the transformers, the lamps, and yet we know that in all the space around there is activity. Waves are chasing each other through this room, through our streets, our houses, our offices. They are everywhere present. We are bathed in this agitated medium every moment, and yet we live, and not only live but are totally unconscious of the activity that surrounds us. No sense responds to the wave motion that fills this space. And yet, when these waves become short enough and frequent enough, they do affect our sense of vision, and a vast array of phenomena that otherwise would have had no existence for us, are made known to us through this special sense. But the eye only responds to waves of $\frac{1}{36000}$ to $\frac{1}{67000}$ of an inch in length, while the length of the waves emitted by one of our alternating current systems is 600 miles. The waves that affect the eye must occur at the inconceivable rate of at least 400 millions of millions per second, while less than 300 waves per second are emitted from our alternating systems. These waves come very far short of the number necessary to effect any of our senses; but we have been able to demonstrate their existence, at least we have been able to show that something possessing all the characteristics of wave motion exists in the space around a source of alternating currents or potentials. It is something to know that waves of such enormously different lengths and frequencies exist in the medium that is agitated by waves of light. It is something to understand that our sources of alternating currents are centers of radiant energy, differing from light only in wave length; and since we have begun to appreciate this fact, we have often asked ourselves the question, Can the rate of alternation be increased until the whole apparatus should glow with light? Although the enormous rapidity required seems to render this direct solution im-

possible, it seems to me there must be a way to obtain the light we want without all this waste of energy. I cannot believe it will always be necessary to develop waves of all lengths, from many miles down to a hundred thousandth of an inch, in order to obtain the narrow range of wave lengths by which we see. I do not know of any practical way of obtaining the few wave lengths that constitute light without, at the same time producing the others, but it is done. The glow-worms do it, the fire-flies do it, the lantern-beetles do it, and I believe the time is coming when man can do it. Instead of getting ten 16-candle lamps per horse-power we ought to get 200. I don't know how it is to be done. I don't expect we are going to make alternating machines to produce 500 millions of millions of alternations per second. But possibly we may solve the problem indirectly by the use of some substance having a special rate of vibration, such as the gases. Possibly we may be able to excite electrically the fluorescent salts. Possibly we may be able to charge and discharge a condenser and take advantage of the oscillatory discharge to set up vibrations of the frequency required. Possibly we may discover the secret of the glow-worm and fire-fly and substitute electric for the insect energy. I know it will take several fire-flies to equal a 16-candle lamp, but it will also take a good many fire-flies to develop a horse-power. But although I do not see at present any practical solution of the problem, I repeat, I believe the problem can and will be solved. We are not going on forever burning a coal mine whenever we want a little light. Neither are we going on forever converting the energy of coal into heat when it is mechanical or electrical energy we want. From the very nature of things, not more than one-fourth or one-third the heat so produced can be transformed into any other form of energy. The energy of fuel *can* be converted into mechanical energy without first becoming heat. It is so converted in every animal movement. The way exists; let us find it. Find this, and the way to make light only when it is only light we want, and we shall have lengthened the life of our coal deposits five or ten times. The man who solves either one of these problems will be the greatest discoverer of this or any other age. If he gets a broad patent on it, he will have 17 years of the grandest litigation the world ever saw.

Now, I can imagine that some electrician will consider that the first part of this paper dealt with matters that are of no practical consequence in the use of electric currents. Of what practical consequence is it whether force is conveyed to a distance by means of a medium or simply acts at a distance? What does it matter whether electric energy is conveyed by the conductor or through the di-electric? We know how to proportion and dispose our conductors to produce a given effect, and that is enough. But consider what we have learned already of the intimate connection between light and electricity, and I think you will agree that the more we know of the ultimate nature of electricity, the nearer we shall be to the solution of the great problem to which I have referred, and the solution of either one of those problems would revolutionize some of the most important industries of the world. May not the solution of at least one of these problems be accomplished and the results exhibited at the great exhibition to be held in New York in 1892? What a wonderful achievement it would be to light all those great buildings without heat, or drive all that vast array of machinery without a fire.

Electric Lighting at Norwalk, Conn.

The annual meeting of the Norwalk and South Norwalk Electric Light Company was held at Norwalk, Conn., on Monday, January 13. The year's business showed a most encouraging increase. The station has been very materially enlarged; a new 90 horse-power Ball engine, with boilers, has been installed; 1,300 Thomson-Houston incandescent alternating current lamps have been added, together with a 50-light Schuyler arc dynamo.

The plant was put in by the Schuyler Company in 1886, and since the day of starting has paid regularly a quarterly dividend of two per cent., and the stock is eagerly sought for.

At the stockholders' meeting, the following directors were chosen: Hon. Charles Olmstead, Hon. G. R. Cowles and John H. Hoyt, of Norwalk; Chas. E. Dustin, of Hartford, and Edward T Jackson, of Middletown. The officers for the year are Hon. Chas. Olmstead, of Norwalk, president; Hon. G. R. Cowles, Norwalk, vice-president; Chas. E. Dustin, treasurer, and John H. Hoyt, Norwalk, secretary.

—— At a town meeting, in Mexico, N. Y., a five years' contract was made with the local lighting company for 25 arc lamps. The company is using the Schuyler system and is much pleased with it.

In Relation to Outside Electric Light Currents.

The Boston Manufacturers' Mutual Fire Insurance Company has issued a special circular regarding the hazard from outside electric currents, which is as follows:

Electric lighting was first introduced in a very few risks insured by this company before the year 1881; in that year, and in the first six months of 1882, it was adopted in a very considerable measure. In this period of its early introduction, prior to the first of April, 1882, we received notice of 23 fires which had been set by the electric current in only 61 mills which had then been equipped. No claim for loss was made on any of these fires, but they disclosed conditions which were very alarming to us. An immediate investigation was made, under the direction of Mr. C J. H. Woodbury, and certain rules were adopted for putting up the apparatus, insulating the wires, and guarding against the dangers disclosed in these 23 fires. These rules were immediately submitted to all the electric light companies or manufacturers of electric lighting apparatus who had any standing in the community, and were at once adopted by them, as well as by all insurance companies. They have not been changed since that date except so far as new inventions have called for modifications.

Since April 1, 1882, a period of nearly eight years, we have received no notice of any fire which could be attributed to electricity, in any risk insured by this company, and of course no claim has been made upon us for a loss which could be attributed to this cause. Our experience, therefore, justifies the conclusion to which we came after the first two years of electric lighting, that under proper safeguards it is the safest method of lighting that can be introduced. Electricity has also been applied in some of the works insured by us as a motive power, and electricity is now applied to lighting or motive power in over 600 risks which are insured by the factory mutual companies.

Attention, however, has lately been called to the danger of wild currents of electricity generated on the wires which may be in use for lighting, for power, and for the railway service in many cities. There appears to be very little doubt that the recent destructive fire in Boston originated in the diversion of a high tension current of electricity from its own wire to an electric clock wire, on which it was carried to the building in which the fire originated. There appears to be little doubt that this conflagration may be attributed to the lack of precaution in guarding against an outside current of electricity. Such currents may be carried from their proper wires to other points in all cities or towns in which electric light or power is widely distributed on the public streets or over private buildings.

In order to guard against this hazard, the owners and managers of mills and works insured are advised to establish the following rules for the protection of their premises. These rules, after having been drawn by us, have been submitted to experts in various branches of electric science, who are of the highest authority. The forms have been modified by them, again considered on our own part, and are believed to be suitable for what may be called an emergency.

The same insurance company has issued the following rules for guarding insured property against the hazard of stray currents of electricity generated outside of mill yards:

1. No foreign wires of any kind shall be attached to buildings insured by this company, for the purpose of carrying electric currents across the yard to any point.

2. All electric wires which may be required by the insured shall enter the premises at one point, near the headquarters of the night watchman, where they can be kept under supervision; each of said wires shall be guarded by a protector against strong currents, operating by opening the circuit, and by a lightning arrester.

3. Such protectors against strong currents shall be located in a dry, accessible place inside the building, and as near the point of entrance of wires as possible, and shall be without ground connection; such protectors shall be mounted on non-combustible and insulated supports, which shall be provided with a receptacle for the burning or melted parts of such apparatus.

4. The lightning arresters on all wires must be placed between the protector against strong currents and the electrical portion of the apparatus within the building to which such wires are connected. No ground wires for such lightning arrester shall be attached to gas pipes within the premises of the insured.

5. All electric wires which may enter the premises of the insured must be insulated, between the line wire on the insulator attached to the buildings outside and the protecting device within, with the best quality of waterproof insulation. Moreover, such wires must enter at a distance of not less than three inches from any other wire or any conducting material.

6. If any wires carrying high tension or strong currents are to be carried over or under other wires on the property of the insured, they shall be attached to poles so near to each other, with one wire so far above the other, that if a break should occur, the pendent wire between these poles may not be long enough to come in contact with the wire below, or, if not carried on poles, these wires shall be so placed or protected with guard-wires as to render a contact between different wires impossible.

7. If the high and low tension systems are in use in the same yard, even when developed within the works, the wires must be kept separate, and so wide apart that no contact or cross arc can be made.

A New One.

[From the Washington *Star*.]

Banana-peel and orange-skin long held the field alone
In "doing up" the muscles and shattering the bone.
Banana said to orange: "There is none that can compete
With us in gathering mortals from off their mortal feet."
"Oh, no!" spoke up the orange, "we're the surgeons' greatest friends,
And when beneath the leather, then the human form unbends."
"Ah! ha!" spoke up the new one. "I am with you heart and soul.
I am not so devilish slippery, but, gosh, how I can roll.
Though newly on the market, my record it is bright,
I'm the remnant of a carbon from an arc electric light."

Complimentary Dinner to Mr. E. H. Johnson.

A very agreeable dinner party was given by Mr. H. McL. Harding and Mr. J. L. Barclay, of the Sprague Company, to their former president, Mr. Edward H. Johnson, at the Hoffman House, Monday evening of last week. A number of the gentlemen who had been Mr. Johnson's associates with the Sprague and with the Edison Companies were present, including Hon. John H. Wise, Samuel Insull, J. H. Vail, S. Dana Green, H. W. Blake, F. J. Sprague, J. K. Muir, Frank Johnson, T. C. Martin, C. W. Price. The best of feeling prevailed, and all the gentlemen, in responding to toasts, expressed their esteem and respect for Mr. Johnson in very complimentary terms. Mr. Vail presented a series of resolutions, on behalf of Mr. Johnson's associates and the employés of the Sprague Company, which he stated would be engrossed.

Orange, Texas.—An electric light company has been organized here with a capital stock of $25,000.

Cobourg, Ont.—Letters patent have been issued to the Cobourg Electric Light Company; capital stock, $45,000.

Hamburg, N. Y.—The Hamburg, N. Y., Water and Electric Company will increase its capital stock from $12,000 to $50,000 for the purpose of enlarging the plant.

Dayton, O.—The Dayton Electric Light Company, Dayton, increase of capital stock from $180,000 to $200,000. The company will enlarge the plant immediately.

Grant's Pass, Ore.—The Southern Oregon Telegraph and Telephone Company; Captain J. A. Brown, J. T. Flynn and Jeff. W. Hayes; with a capital stock of $10,000.

East St. Louis, Ill.—The Citizens' Electrical Supply Company, of East St. Louis; capital, $1,000; Messrs. H. D. Sexton, S. B. Sager and Martin D. Baker, incorporators.

Chicago, Ill.—The Fidelity Electric Light Company, at Chicago, to establish an electric light plant; capital stock, $15,000; incorporators, G. M. Morgan and F. A. Shoemacher.

Springfield, Ill.—The Municipal Light and Power Company; to furnish light, heat and power; capital stock, $25,000; incorporators, E. B. Preston, Hartwell Kendall and O. C. Mackenzie.

Chicago, Ill.—The Municipal Light and Power Company, at Chicago; to furnish light, heat and power; capital stock, $25,000; incorporators, E. B. Preston, Hartwell Kendall and O. C. Mackenzie.

Rockford, Ill.—The Rockford City Railway Company, at Rockford; to construct and operate a street railway; capital stock, $50,000; incorporators, H. W. Price, Anthony Haines and Levi Rhoads.

Multnomah, Ore.—Albina Light and Water Company; with H. C. Campbell, G. W. Bates and C. F. Swight; capital stock, $50,000, in shares of $100 each; principal place of business to be in Multnomah.

Westchester, Mass.—The Westchester Electric Company, of Westchester, has been organized; for generating and distributing electricity for both light and power purposes. The capital is $50,000.

Chicago, Ill.—The American Electric Motor Company; to manufacture and sell electric motors for street cars, etc.; capital stock, $1,000,000; incorporators, E. G. Geisler, J. W. Adams and Louis M. Hopkins.

Skaneateles, N. Y.—The Central New York Electric Light and Power Company, which was incorporated last summer by citizens of Skaneateles, with an authorized capital of $100,000, for the purpose of supplying electric light and power to Skaneateles and neighboring villages, have bought lands in the town of Elbridge. It is proposed to build a dam for the purpose of running the company's plant by water power.

Portland, Me.—Certificate of incorporation has been filed of the Patent Pneumatic Bell Alarm Company. Its purpose is to carry on the business of manufacturing and selling or leasing pneumatic bell alarms and signal apparatus. The capital stock is $500,000, of which $300 are paid in. The officers are, president, Charles B. Sawyer, South Braintree, Mass.; treasurer, William A. Copeland, Mansfield, Mass.; directors, William A. Copeland, Mansfield; Charles Parent, Boston; Charles B. Sawyer, South Braintree.

Taylorville, Ill.—The Taylorville Electric Company filed a certificate of the increase of the number of its directors.

Antwerp, N. Y.—The Antwerp Electric Light Company has been incorporated at Albany, with a capital of $12,000. The following were the incorporators: Hon. E. B. Buckley, John D. Ellis, Morgan Angsburg, W. M. Johnson and Myron H. Burt.

Champaign, Ill.—Several citizens of this city are the incorporators of a Citizens' Electric Street Railway Company, of Champaign. Articles of incorporation have been issued. The capital stock is $150.000. A line will be laid to connect with this city and Urbana, with extensions on the principal streets.

Butte, Montana. — The Thomson-Houston Electric Light Company, which was granted a franchise by the city council about two months ago to put in an electric plant in Butte, is getting its business in shape to commence active operations. The company also has in view the operating of electric motors.

Portland, Me.—Hicks Patent Vulcan Compound New England Manufacturing Company; capital stock, $200,000; paid in, $90; par value shares, $10. President, Hiram G. Hicks; treasurer, Willard C. Lamson. Business to be prosecuted, manufacture and sale of the Hick's patent vulcan compound.

Baton Rouge, La.—The directory of the Electric Light and Power Company has call a general meeting of the stockholders for Wednesday, February 26, to decide upon increasing the capital stock from $15,000 to a sum not exceeding $50,000. This move is considered necessary, as the company has determined to equip the plant so thoroughly that there will be no possibility of a failure of light at any time

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It would seem, from an article on another page, that the lot of an electrician in New York is not a happy one, and that he, as well as the others engaged in cable laying operations, has his share of troubles.

It must be aggravating in the extreme after the electrician has spent a whole day in fussing with his galvanometer in the vain attempt to obtain a steady spot of light, to find, after all, that the steel wire in the rim of his own hat was the sole cause of the trouble.

We once knew of an electrician who incurred the ill will of some of his men, who obtained ample revenge by regularly swinging a bar of iron outside of the cable shed whenever he was at work.

If the telephone could be used to replace the reflecting galvanometer, as suggested in the article referred to, it would be hailed as a distinct advance in the methods of electrical measurement.

It is expected that the "Electric" train, to leave here February 9, to go through without change to Kansas City, Mo., to the Electric Light Convention, will be the most complete and handsome train that ever left New York. It is now evident that the train will be well filled, and all Eastern electrical people who expect to attend the convention should see that accommodations are secured at once.

THE BRUSH-SWAN DECISION.

Judge Cox, of the U. S. Circuit Court, Southern District, New York, on Friday, January 17, handed down a decision of considerable importance to the electric lighting industry. It was in the case of the Brush-Swan Electric Light Company, of New England, which is now, we believe, controlled by Westinghouse, against the parent Brush Electric Company, of Cleveland, which is now controlled by the Thomson-Houston Electric Company, of Boston. The decision was in favor of the Brush-Swan Company, and, it is claimed, gives to that company the exclusive right to sell Brush apparatus in all New England as well as in Eastern New York and Pennsylvania.

The decision of Judge Cox orders an accounting before a master in chancery, and enjoins the Cleveland Company from doing business within the territory named.

This brings into prominence again the Brush-Swan Company of New England, and, we suppose, carries to that company the benefits for its territory of the recent decision by Judge Gresham in favor of the double carbon patent of Chas. F. Brush. If this is the case the electric lighting situation in relation to patents and to parent companies becomes still more mixed, and the three giant organizations in the field will be compelled to again change positions on the electrical chess board.

THE BUREAU OF PATENTS.

The House committee on patents has been directed to investigate and report, by bill or otherwise,

First. What change in existing patent laws is necessary to correct any alleged abuses, and render the system more perfect and efficient.

Second. Whether the Bureau of Patents has sufficient room and facility for the proper and prompt discharge of the business brought before it.

Third. Whether the force employed is adequate and the compensation of examiners sufficient to secure and retain an efficient corps.

TWO NEW BOOKS.

There are few American readers of our valued contemporary, *The London Electrician*, who will not remember the interesting series of papers which appeared in its columns in the latter part of 1887, entitled "Letters for Learners and Unprofessional Readers." This series of papers, which was begun by Mr. A. E. Kennelly and finished by Mr. H. D. Wilkinson, created considerable interest at the time, especially among that class of young Americans who, through business channels, had come to where some accurate knowledge of electrical matters had become an imperative necessity to them. In fact, we have once or twice, in electrical work shops, run across these papers carefully cut out of the journal in which they appeared, and pasted into a scrap book which bore evidence of being often consulted, from its much bethumbed condition.

It is with much pleasure, therefore, that we notice that Mr. Wilkinson has republished the articles in a handsome, well indexed volume of 300 pages. The book evidently does not profess to be a complete work on electricity, neither are the subjects of which it treats arranged in the conventional way; as may be seen from the fact that the opening chapter, after devoting one page to the early conceptions of the nature of electricity and modern views regarding electrical energy, boldly tackles the oft disputed and rarely attained "Requirements of a good (voltaic) cell."

Chapter II is devoted to primary batteries, and though the subject is not treated broadly, the few types described are sufficient to set the young reader thinking. Electro-motive force and potential form the theme of a whole chapter, which is followed by one on resistance. These two chapters are sufficiently explicit to prepare the reader for Chapter V, which, though short, is really a very good treatment of that much misunderstood term, current. The following chapters on "Current Indicators," "Simple Tests with Indicators" and "Calibration of Current Indicators," are really very well written, and set forth easily understood ideas on subjects difficult of comprehension without laboratory practice.

The last chapter on "Permanent Magnetic Fields, Electro-Magnetic Fields and Magnetic Fields of Coils and Solenoids," would form a small book by itself, as it comprises some 125 pages of close reading matter. It treats of its subjects with a singular freedom from mathematics and yet with great clearness. Perhaps one reason why the formulæ used are peculiarly suited to those unfamiliar with such matters is the fact that the author has gone to the trouble of almost informally using words expressing quantities rather than letters. At the end of the volume is a table of natural tangents, with a few explanatory notes regarding the use of the same. The title of this volume, which will find considerable use among those, who, on the one hand, do not simply wish to be amused, and on the other do not expect an exhausted treatise, is "Practical Notes for Electrical Students," Volume I.

Perhaps there is no class of literature more desired and more striven after at the present time than popular expositions of scientific matters, and particularly electrical matters.

Unfortunately, those who have absolutely no knowledge of scientific subjects will rarely read a book which is not amusing in itself, independent of the useful information it may contain; and, on the other hand, but few men qualified to write authoritively on scientific matters are capable of writing an amusing book. Humboldt and Faraday unconsciously wrote in a style that has caused thousands of unscientific persons to burn the midnight oil, yet we do not often see persons reading Faraday on the railway cars.

Every now and then some electrical author tries to write a book which shall find its way into the hands of the general reader and educate him, whether he will or no. Such a work was the charming book entitled "The Age of Electricity," from the pen of Park Benjamin. This book, which appeared four years ago, did much to educate the general public on electrical matters, for few people could read his charming opening chapter on "The Myth of the Amber Soul," without wishing to keep on to the last page.

Prof. G. W. de Tunzelmann, of London, has just written a similar work, under the title "Electricity in Modern Life." His opening chapter on "What We Know About Electricity," and the one following it on "What We Know About Magnetism," are sufficiently light to hold the attention of a reader who is averse to mental gymnastics, and yet they are sound and pregnant with facts. The middle portion of the work is devoted to untechnical considerations of the mutual actions between magnets and currents; force work and power; sources of electricity; magnetic field and electrical measurement; while the concluding portion of the work is devoted to descriptions of various forms of electric apparatus, such as telegraph, telephone and electric light apparatus. Medical electricity and electricity in warfare, each come in for a separate chapter. Possibly, what at once strikes the reader familiar with standard works, is the fact that the book in question contains but very few cuts that have not already become familiar in the works of Sylvanus P. Thompson, Preece, Siveright, Maier and Sabine. It must be said, however, that these cuts are used with permission, and chosen with discrimination.

ELECTRICAL NEWS.

What is Transpiring in Electrical Circles in the Leading Cities.

OUR BOSTON LETTER.

Society of Arts.—A regular meeting of the society was held last Thursday evening, at the Massachusetts Institute of Technology. Mr. Anthony C. White, of the Bell Telephone Company, read a paper on "A Combination Voltmeter and Ammeter for Battery and Electric Light Work," which was listened to with interest by a large number of members and their friends.

The Business Men and citizens of Marlboro and Hudson, Mass., are much interested in the matter of an electric railway which shall connect the two towns. The Marlboro Street Railway Company, an electric concern having this scheme in view, has petitioned the legislature for authority to increase its capital stock to $100,000. The legislative committee is to give a hearing on the matter next week, at the State House.

Shocking Questions.—A correspondent of the Boston *Globe*, writes to that paper for answers to the following questions. It is, presumably, one of the effects of the discussion now prevalent in this city, in regard to electricity in general:

"1. If a man should hang suspended by one hand from a wire through which a current of electricity was passing—the overhead wire of the West End Railroad, for instance—would he receive a shock?

"2. Would he, if hanging by both hands, a circuit being apparently completed?

"3. Would he receive a shock when hanging by one hand, his feet touching the ground?

"4. Does a current flow through the underground wire of the West End Railroad? If so, why is not a shock received when one foot is placed on each rail, as a circuit would apparently be completed?"

Augusta, Me.—Now that the building of an electric railroad between Augusta and Hallowell is assured, and the contract has been placed, people are interested to know something about the running of the road.

Trips will be made every half hour between the two cities in the busy season, and every three-quarters of an hour at other times.

The fare will be placed at five cents for any distance, long or short. Should the road be extended to Gardiner, 10 cents is to be the fare between that city and Augusta.

The road will not be opened for travel until July 4, when a grand celebration is to occur at the trotting park in honor of the event, a big horse race to form part of the attraction.

Property along the line of the road between the State House and Hallowell is sure to augment in value.

The gentlemen who have contracted to build the road are W. B. Furgerson, Salem, Mass., and E. P. Shaw, Newburyport, responsible men connected with the Thomson-Houston Company. They begin work at once on the opening of the season.

Electric Wire Rules.—The Boston Manufacturers' Mutual Fire Insurance Company has adopted a set of rules for the protection of property insured by the company from fire caused by electric wires. Foreign electric wires may not be attached to buildings. Wires required in a building must enter it near the station of the night watchman, and be guarded by lightning arresters and protectors against strong currents. These protectors must be safely and accessibly located near the point of entrance of the wires, and without ground connection. Lightning arresters are to be placed between the protectors and the electrical apparatus within the building. Ground wires for the lightning arresters must not be attached to gas pipes. Waterproof insulation is demanded, and no wire may enter at a distance of less than three inches from another wire or conducting material. Wires carrying high tension or strong currents must be so strung that, if a break should occur, contact with other wires shall be impossible. High and low tension wires in the same yard must be kept so far apart that no contact or cross arc can be made.

Electric Train Signaling.—There have been many attempts to substitute electricity for the bell cord, but up to the present time all the devices have proved defective. One of the trains on the Boston, Revere Beach and Lynn Road, was equipped some six months ago with a new device, and thus far it has proved a success. Last Thursday afternoon, by invitation of the Johnston Electric Train Signal Company, a number of gentlemen were treated to a public exhibition of the device. Leaving Boston on the 2 o'clock train over the Revere Beach Road, the run was made to Lynn and return, the signal being worked several times very successfully. The Johnston system consists of a web-covered wire cable, which is suspended in the center of the car, and, by means of couplings between the cars, forms a continuous line from the rear platform to the engine. At regular intervals the cable is tapped and push buttons applied; these span the wire, and when the buttons, which are encased in rubber, are pressed, the contact is sure; dust and water cannot get at the bronze points to rust or impede the action. Simultaneous with the touch of the button, the bell in the engine vibrates. On the return to Boston

the guests were taken to Young's, where a fine lunch was served.

Vulcabeston.—The Johns-Pratt Company, of Hartford, Conn., have furnished us the following interesting facts in regard to their now famous "Vulcabeston" or vulcanized asbestos: "Two years ago we were asked by one of the well known electrical manufacturing concerns, if we could furnish them with an insulating asbestos washer. We did so, and our customers were so well pleased with the material that they began ordering pieces of other shapes and sizes, where they particularly needed a strong, durable insulation. Our business in this department has grown so that we now number among our customers most of the large electrical companies of the country, and we are compelled to run part of our works 24 hours per day, and still are behind our orders in this line of goods. Vulcabeston, judging from our orders, is in special demand for large, heavy work; most of our out-put at present being for dynamo, motor and railroad work. To the fibrous composition is due the great strength of vulcabeston. It is moulded in the plastic state, and pressed to the desired form under from 50 to 500 tons pressure to the square inch. Our asbestos packings are meeting with success, and the demand for these goods is making us exert ourselves to the utmost to fill our orders."

"Practical Uses of Electricity."—Over 100 members of the Boston Boot and Shoe Club listened to interesting addresses on the above subject, last Thursday evening, from such well known men as the following: Prof. Elihu Thomson, Thomson-Houston Electric Company; Prof. Charles R. Cross, Institute of Technology; Mr. F. S. Hastings, Edison Electric Company, New York; Mr. H. M. Whitney, president West End Railroad Company; Mr. C. A. Coffin, vice-president and general manager Thomson-Houston Company; Mr. J. N. Smith, vice-president Thomson Electric Welding Company; Mr. H. A. Royce, general manager Thomson Electric Welding Company; Mr. B. F. Spinney. S. L. C.

Boston, Jan. 27, 1890.

OUR WASHINGTON LETTER.

The American Automatic Protector Company, $100,000, $10 shares, is organized in Washington, D. C., to exploit the device invented by J. E. Crandall to protect telephone wires from lightning and electric lighting currents. President S. M. Bryan and other Washington telephone men are the leading spirits in this undertaking.

Perpetual Motion is an accomplished fact. A practical and effective machine has been running in Washington for several years. It consists of a large hopper; a case enclosing some simple wheels and rollers operated by a crank, and a spout. The spout discharges into the pocket of an inventor who turns the crank. Just before one inventor gets tired of turning another takes his place, and the machine grinds on forever. What goes in at the hopper can be ascertained by inquiring of almost any ambitious capitalist about the Federal city. Just now Teknor is at the crank. The power that impels him is faith in a primary battery of wonderful merit. It is said to develop energy unlimited without the consumption of a particle of material, and, at last accounts, it was expected to keep up this operation and turn out large quantities of surplus zinc. The composition of the battery is not to be made public until foreign patents are obtained.

Telephone Legislation.—A few cantankerous telephone subscribers in Baltimore are urging the passage of a bill by the Maryland legislature, fixing the maximum charge for exchange service at $3.00 per month. There is not the slightest chance that the bill will become a law. Its advocates will, undoubtedly, follow the example of many other malcontents, by settling their accounts and trying to lead the public to forget their absurd course.

The Post Office Department has found the stamp-cancelling machines, now on trial in several of the larger post offices, very useful, and there is a probability that as many as a thousand of them will be put in operation within a year. The plan of driving them with ¼ horse-power electric motors has not proved as successful as desired, for the reason that, in a number of places, the current supplied from central stations has been too unsteady and intermittent. Post offices provided with independent lighting plants have less trouble than those dependent upon outside plants. The service demands some motive power that will be reliable and available at all times, day and night, and a motor that does not make much noise.

The Columbia Aluminum Company, chartered in Virginia, $3,000,000 capital, $25 shares, proposes to establish works in Washington, D. C., for extracting aluminum from North Carolina clay, by a process invented by Julius Emmner, Jr. It is explained that the operation is by "combined electricity, fusion and distillation," and it is claimed that the cost will not exceed 25 cents per pound of metallic aluminum, 96 per cent. pure. Mr. Emmner has invented some improvement in storage batteries, in which aluminum supports for chloride of aluminum, as an active material, is to be used, and he expects to require large quantities of the metal for that purpose. This gentleman was the originator of the Emmner Telephone Company, which enjoyed a short existence until enjoined by the American Bell Telephone Company.

The Northern and Southern Electric Company, of Beverly, Mass., has presented a petition, signed by a goodly number of Massachusetts citizens, to the House of Representatives, asking Congress to adopt the electric vote-recording machine invented by John A. Enos, patent No. 287,649. Propositions of this character have been before Congress frequently for years and have received no encouragement. An arrangement which will correctly record a simultaneous vote by the members of a legislative body is just what Congress *does not* want.

A Railroad to the Tomb of George Washington.—The Washington and Mount Vernon Railway Company has been chartered by the Virginia legislature, with the right to use electricity as a motive power. The line, which will pass Arlington and Alexandria, will be about 20 miles in length. Of the incorporators, George Truesdell, president of the Eckington Railway, is best known to electrical people. G. C. M.

Washington, D. C., Jan. 25.

OUR CHICAGO LETTER.

The Chas. Munson Belting Company have closed a contract with the Central City Railway Company, Peoria, for 114 feet 42 inch belting and 300 feet 12 inch belting, which will be used in driving generators.

H. Ward Leonard and Mr. Herrick arrived in the city Monday, and were present at the Club meeting in the evening.

The Chicago Electric Club held a meeting Monday evening. The minutes of the previous meeting was read by the secretary, also the agreement of the Eastern delegates to accept of the hospitality of the Club, on February 10, while *en route* to the convention at Kansas City, after which an instructive, interesting and amusing paper was read by Mr. Foree Bain, entitled "Experience as a Teacher in Electrical Engineering." Mr. Geo. Cutler, made a few remarks in reply to the paper. It was then moved and carried that a vote of thanks be given Mr. Bain for the evening's entertainment.

Geo. B. Shaw, manager of the National Electric Company, of Eau Claire, Wis., was at the Sherman House this week.

The Markle Engineering Company, of Detroit, have a new porcelain cut-out, which they will soon place on the market.

Mr. Geo. Cutler has placed Mr. D. T. Everts on the road as his representative. Mr. Everts is commended to the kindly acquaintance of the electrical industry. Mr. Cutler has added a repair shop to his warerooms on Adams street, using an Excelsior arc motor for power; he is also in receipt of a large stock of constant potential lamps of the Bernstein make. D. B. D.

Chicago, January 24th.

SOUTHERN ELECTRICAL NEWS.

Ocala, Fla.—A 50 arc and series incandescent light plant has been placed in the exposition building. Thomson-Houston system.

Jacksonville, Fla.—A 1,300 arc and incandescent plant is being placed for city lighting. Thomson-Houston system.

Brunswick, Ga., has started a new Thomson-Houston plant of 100 arc lights.

Americus, Ga.—The Americus street railway is in running operation under the Thomson-Houston system.

Goldsboro, S. C., has been supplied with 650 incandescent and 50 arc lights. Thomson-Houston system.

Fernandina, Fla., has increased its electric light plant 650 lights. Alternating Thomson-Houston system.

The Atlanta Exchange of the Southern Bell Telephone Company has recently received large shipments of hard drawn copper wire, for the purpose of giving all their subscribers a common return wire, virtually making the exchange a metallic circuit exchange.—Superintendent Cole has recently returned from an extended business trip in Alabama.—An electric club is in process of formation in Atlanta, consisting of all the leading electric light, street railway system, telephone, telegraph, phonograph men, and all interested in electricity. About 30 names have thus far been signed.

A Much Travelled Telephone Man.—Mr. A. W. Prior, formerly chief operator in the telephone exchange, arrived in this city on the 18th, from Australia. Mr. Prior is one of the most thoroughly equipped telephone men that could be found. Since leaving Atlanta, two years ago, he has personally inspected all the large exchanges of the Old Country, making a thorough examination of the telephone business in London, Paris, Berlin, Bombay, India; and thence sailing direct to Australia (Melbourne). He has resided in Australia for more than a year, and has investigated the various systems of telephones in use there. He has temporarily assumed the management of the Anniston telephone exchange in Alabama.

Atlanta, Ga., Jan. 18, 1890. F. E. C.

Electrical Testing in New York.

[Written for the ELECTRICAL REVIEW, by Herbert Laws Webb.]

Fine testing with delicate instruments is carried on in New York under very disadvantageous conditions. Of all the great cities of the world, New York is about the last which a careful and painstaking electrician would choose to do work in with a Thomson galvanometer.

Of what avail is it to a man to have a brilliant set-out of keys and switches of shining brass and darkly gleaming hard rubber, a tip-top Marshall condenser and a superb Wheatstone bridge, if his "spot" is constantly wandering over the scale in an erratic and most intensely aggravating manner before he presses down a lever, or pulls out a plug? What reliance can he place upon his deflection if that wayward spot oscillates 30 or 40 degrees when the needle is deflected into the hundreds, and never goes back twice to the same zero? Again, how can he hope to read with that exquisite accuracy which is a "spot-watcher's" delight and pride, if the spot is jumping up and down on the scale at a "frequency" of 100 per second?

That little spot of light is the key to the whole situation. If it is not free from oscillations and vibrations, the whole outfit is next to useless. Bridge, condenser, keys and switches are so much brazen mockery, and the electrician's frame of mind is truly the abomination of desolation at his inability to conquer the vagaries of that volatile spot. The causes of the vagaries may be summed up in three words—machinery, elevators and elevated railroads. The electric light machinery which is to be found in the basement of nearly every large building in New York, maintains everything above it in a constant state of vibration, to which the needle of a reflecting galvanometer, suspended by a single fibre of raw silk, is extremely sensitive; hence the trepidation of the spot. The elevators, ceaselessly ascending and descending, and the trains on the elevated railroads, produce direct magnetic disturbance of powerful effect; hence, the oscillations before referred to.

The proper position for a reflecting galvanometer is on a pedestal of masonry built on a good foundation and not in contact with the flooring, or, in fact, with anything capable of imparting the least vibration; it should also be away from the neighborhood of any moving masses of iron, so as to secure freedom from magnetic disturbance. Such conditions are unobtainable in New York, or at any rate, in the lower part of the city, and we are obliged to set up our instruments on upper floors of lofty buildings shaken from their very foundations by heavy machinery, with elevators running within a few feet of the testing-room, and trains passing a few yards further off every minute or so.

A reflecting galvanometer placed on an ordinary bench in such a situation is absolutely useless. Expedients have to be resorted to in order to get rid of the disturbances. The vibration is got rid of by placing the galvanometer on a shelf supported by long brass springs from a bracket fixed on the most solid wall available, and the other instruments are set up on a separate bench or table. But the slinging shelf is apt to be a trial to the electrician's patience and a source of peril to his soul. Let him catch his sleeve in the galvanometer leads, or brush ever so lightly against one of the springs, and the mirror receives a sudden shaking up, throwing the spot into violent convulsion for an indefinite space of time. However, occasional convulsions are better than perennial St. Vitus' dance, and the springs are imperative in buildings where there is machinery constantly at work. Mounted in this way satisfactory results can be obtained with a well constructed astatic galvanometer, if it is sufficiently far removed from the influence of elevators and other moving masses of iron. If such disturbing agents are at hand, however, an iron shield encasing the galvanometer becomes necessary, perhaps the best form being an old safe. With a "dead beat" instrument such a shield is an absolute necessity, if any degree of sensitiveness is required, as the needle, being non-astatic, is then extremely sensitive to magnetic influence.

The subject might be enlarged upon to a considerable extent, but enough has been said to show that the lot of an electrician who has fine testing to do in New York is anything but a happy one. Perhaps some day he will no longer be a "slave of the lamp," but will be able to search out his megohms and microfarads and ohms at less cost to his eyesight and his temper than at present. Already some steps have been made in this direction, and others may be approaching through the dim future. It is not unlikely that that marvellously sensitive instrument, the telephone, which picks up so many currents never intended for it, may some day be turned to account for accurate testing, as it already has been for localizing faults. The writer does not at present see his way clear to devising a substitute for the aggravating spot; if he did, readers of the REVIEW would first learn of it through another column, nearer the end of the paper, but it is not too much to hope that eventually some such device will be given to the electrical world, and the inventor will, no doubt, meet with his due reward, and will certainly earn the gratitude of electricians engaged in testing under such conditions as are prevalent in New York.

GENERAL ELECTRICAL NOTES.

The Mitchell-Vance Company has withdrawn from the Electric and Gas Fixture Manufacturers' Association.

The Kinsman arc lamp (low voltage) has been purchased by the Edison interests. This takes in, also, the Kinsman Construction Company.

An unique and serviceable calendar has been received at this office, from the Central Electric Company, of Chicago. The lettering is formed of conventional lightning flashes, and "Okonite" holds a prominent place.

Mr. Daniel L. Gibbens has resigned from the Board of Electrical Control, of this city, his resignation having been forwarded to Governor Hill early last week. Up to the present time a successor has not been appointed.

The Consolidated Gas and Electric Light Company, of Westchester county, has been formed by Charles B. Ludwig, Brooklyn; Harold S. James and Arthur B. Elbecke, New York; Hanford M. Henderson, Port Chester, and Leonard G. Levy, Newark, N. J. The operations of the company will be carried on in the towns of Rye, Mamaroneck, New Rochelle, Harrison and Scarsdale.

Referring to the decision in the Brush-Swan case the final clause states that the decision shall "not interfere with any existing contracts made by the Brush Company with local companies, or restrain the Brush Company from furnishing supplies and apparatus for established plants." The Thomson-Houston people say they are content so long as the Brush Company can continue to furnish its present stations, and that the Brush Company, which it controls, will get all the profit from future business, whether done by the Thomson-Houston or Brush-Swan Company, inasmuch as the Brush-Swan Company, having no manufacturing license, is bound under the contract to secure all its apparatus from the Cleveland Company.

Exhibitors at Kansas City Convention: Edison Machine Works, Sprague E. Ry. and Motor Co., Eddy E. Motor Co., C. & C. E. Motor Co., ELECTRICAL REVIEW, *Electrical World, Western Electrician, Electrical Engineer, Electrical Power, Electric Age, Electrical Industries, Modern Light and Heat*, Central Electric Mfg. Co., Eau Claire, Wis.; Gate City E. Co., Kansas City; Okonite Co., Nat. Carbon Co., Cleveland; Southwestern E. Supply Co., Standard Carbon Co., Jewell Belting Co., Chas. D. Jenney & Co., Chas. A. Schieren & Co., Royal Silk Mfg. Co., James. N. Queen & Co., Phœnix Glass Co., Ansonia Brass and Copper Co., Detroit Motor Co., Fred. H. Whipple, Western Instrument Co., American Electrical Works, Palermo Mica Co. Also the following will probably exhibit at Kansas City: Central Electric Co., Chicago; Simplex Electrical Co., Boston; Solar Carbon Co., Pittsburgh; Munson & Co., Chicago; Ricker Electric Motor Co., Brooklyn.

Telephonic News

⁂ The recent storms have caused much destruction of property throughout the country, especially among the telegraph and telephone companies. At Rochester, N. Y., the electrical service was entirely destroyed for a considerable time, including the fire alarm system.

⁂ The first submarine telephone line —running between Montevideo and Buenos Ayres, A. R.—is 32 miles long, the entire length with the overland line being 180 miles. There are five intermediate stations, all of which can telephone and telegraph simultaneously with all the other stations.

⁂ C. F. Annett, general manager of the Rocky Mountain Telephone Company, says that the business of communicating verbally with one another, by wire, out in that region, is becoming very fashionable among the people, which naturally gives his corporation all it can attend to. "We now have speaking connection," continued Mr. Annett, "with 150 towns. Our longest continuous line extends from Nephi, south of Salt Lake, to Franklin, Idaho, on the north."

⁂ The Telephone Exchange at Cambridge, Mass., has now 12 metallic circuits in operation, which are said to be giving good satisfaction, and appear to be the only remedy for the existing troubles. The first of March is now set as the time for the removal of the Cambridge Exchange to the new Insurance Building. The delay is caused by the difficulty in getting the necessary cables made, owing to the many orders on hand by the manufacturers.

⁂ An employé of the Chicago Telephone Company walked into the city clerk's office a few days ago and asked to be shown the general telephone. It was pointed out to him, and in five minutes he had the wires cut and had walked off with the instrument. All the other city departments were served in the same way. The company claims that the city has not paid for the use of the telephones; but an official said that when the company was granted the privilege to string its wires a condition was that the city departments were to have the telephones free of charge.

⁂ An electric railway ordinance has been adopted by the Indianapolis, Ind., board of aldermen which will be of interest to the electric railway and telephone interests of the country. The following section is especially interesting: "That if electricity is adopted and the overhead system used, then the Citizens' Street Railway Company shall place iron poles between their double tracks and suspend the wires from an arm on the said poles, and the said poles, wires and fixtures shall be so placed and maintained as not to interfere with the reasonable and proper use of existing telephone wires."

⁂ Telephones and speaking tubes are of greater antiquity than most persons are aware. The speaking tube is a contrivance mentioned in ancient writers, and comes down to us or survives just as candles and oil lamps have not been altogether superseded by gas and electricity. In 1667, Robert Hooke, of London, described how he transmitted sound by means of a wire to considerable distances. Wheatstone described his "telephone" in 1821, and in 1854, Ch. Bourseul said: "Suppose a man speaks near a movable disk sufficiently pliable to lose none of the vibrations of the voice, that this disk alternately makes and breaks the currents from an electric battery, you may have at any distance another disk which will simultaneously execute the same vibrations. It is certain that in a more or less distant future, speech will be transmitted by electricity."

⁂ Nine miles of the telephone line between Zanesville and Cambridge, Ohio, has already been completed.

⁂ At a meeting of the directors of the New England Telephone and Telegraph Company, held in Boston on the 22d inst., a dividend of $1.25 per share was declared, payable on Saturday, February 15, 1890, to stockholders of record at the close of business on Friday, January 31, 1890. The transfer book will be closed from February 1st to February 14, 1890, both days included.

Electric Transmission of Power at Bourganeuf.

The source of power is a waterfall situated at "Les Jarrauds," on the Maulde, a distance of 14 kilometers from Bourganeuf. The water actuates a horizontal turbine which is capable of giving out a maximum power of 130 horse-power at a speed of 150 revolutions per minute. From the turbine the power is transmitted to the dynamo on the floor above by means of two belts, there being two pulleys on the dynamo. The generator has two armatures, both on one axle; they are wound with wire 2.2 mm. in diameter, and have each a resistance of 2 ohms. The section of each wire is 3.8 square mm., thus giving a section of 7.6 square mm. for the current, which may be 35 amperes without excessive heating. The two armatures are joined up in series, and can give an E. M. F. of 5 to 5.5 volts for each revolution per minute.

The electro-magnets are separately excited by a current of 20 amperes and 90 volts.

The line is metallic, and consists of a siliceous bronze wire 5 mm. in diameter, carried on porcelain insulators. The total resistance of the line is 23 ohms; the insulation is found to be very perfect, even in wet weather.

The motor is of exactly the same type as the generator, and is also separately excited, current being taken either from one of the lighting dynamos or from a battery of accumulators. The motor is used to drive the dynamos which supply current for lighting the town; these are Gramme dynamos, giving an output of 250 amperes and 120 volts.

At some preliminary experiments made with the generator and motor before they were installed at Bourganeuf, with an artificial line of 30 ohms, the lighting dynamos gave collectively an output of 385 amperes and 112 volts when the generator was developing 22 amperes and 3,750 volts. In a second experiment, with 25 ohms resistance in the line, the lighting dynamos gave 376 amperes and 115 volts when the generator was giving an output of 20 amperes and 3,550 volts. The lighting dynamos used having a commercial efficiency of 80 per cent., whilst the Deprez dynamos are said by the author to have a commercial efficiency of 90 per cent., the results actually obtained might be improved upon; and there is no doubt that a power of 60 horse-power might be obtained at Bourganeuf with 100 horse-power at the turbine at "Les Jarrauds."—*Comptes Rendus.*

A Sensational Electric Lighting Scheme.

It has come to our ears, says a London exchange, that a most extraordinary enterprise is on foot in Derbyshire. According to our informant, a peculiar formation exists in one of the lead lines in that country. Not only is there a marked stratification of almost pure lead, in the form of thick plates, but by a natural chemical action, not easily explainable, the plates are coated evenly with peroxide of lead. Several enterprising capitalists have, it is said, taken advantage of this remarkable arrangement, and have succeeded in making a case of insulating and acid proof around and under the whole formation. The next step will be to erect a large number of lightning conductors in the vicinity of the mine to charge the vast "accumulator," and the supply to be obtained from one electrical storm of ordinary severity, will, it is expected, be sufficient to light the entire country, yielding at least 10,000 ampere hours.

The Cincinnati Case.—The Telephone Side.

Electricians and capitalists all over the country are awaiting with interest the decision which will be rendered by the Superior Court of Cincinnati, in the case of the City and Suburban Telegraph Association *vs.* The Mt. Auburn Incline Plane Street Railroad Company, operating the Sprague system.

It will be remembered by readers of the ELECTRICAL REVIEW that this is a test case of the telephone *vs.* the single trolley system of electric railways. Expert testimony has been profuse and profound on both sides, and it will be of interest to our readers to note what Mr. Nelson W. Perry, E. M., of Cincinnati, has to say as an expert for the plaintiff, at the request of their counsel.

Mr. Perry's testimony follows:

The questions involved apparently are:

1st. Has the telephone company a right to the monopoly of the earth as a return for its current, and, as a corollary, does it, by the use of such a return, monopolize the earth?

2d. If it has not, does the electric road, with ground return, offer greater objections than other currents using the ground, and if it does, as a corollary, has it a right to the monopoly of the earth as a return?

3d. If neither is entitled to a monopoly of the earth as a return, how can the interference be remedied?

4th. If it can be remedied by both parties, which should be compelled to make the change?

5th. If the telephone company should make the change, and the railroad remain the same, would all danger be obviated?

6th. If the railroad company should make the change, and the telephone system remain the same as at present, would all danger be obviated?

7th. Which wires are per se dangerous?

8th. Does the railroad interfere with the telephone, or the telephone interfere with the railroad?

We will show that the answers to the above are as follows:

1st. The telephone company has not the right to monopolize the earth as a return circuit for its electric current; neither has the railroad company.

To the corollary: The telephonic current, by utilizing the earth for a return, does not by so doing either monopolize the earth nor the air, but the railroad company's current does both.

2d. The electric road, by using the earth as a return for its current, does offer greater objections than any other electric currents now in use, except the alternating currents, because of its variable character and high E. M. F.

3d. Danger to life and property can only be completely removed by forbidding the use of the earth as a portion of the circuit of any high potential electric current.

Leakage and induction may both be completely prevented if either circuit be wholly metallic and properly constructed.

4th. If the railroad should make the change required, and the telephone circuits continue as now, all danger, both to life and property, would be avoided.

6th. If the telephone company should make the change required, and the railroad company's circuits continue, the danger to life and property would be slightly lessened, but by no means entirely removed.

7th. All high potential currents are dangerous per se. On the other hand, no telephonic currents are, under any circumstances, dangerous.

8th. The railroad company's current interferes with the telephonic currents. The latter do not in any way interfere with the former.

(I.) It is an admitted fact that the telephone service is interfered with by the operation of the single trolley (ground return) electric railroad. It is in evidence that this interference is caused in three distinct ways, viz:

1st. By leakage.
2d. By static induction.
3d. By dynamic induction.

It is a law in the flow of electricity that it will distribute itself throughout all paths to which it has access in proportion to their conductivity.

If, now, two currents of unequal strength use the earth as a common return conductor, the stronger current, while it will, in most part, return by the earth, will overpower the weaker current to a greater or less extent, and return partly by the metallic path of the latter in conformance with the law above enunciated.

In the case in question, a portion of the powerful street railroad current utilizes the telephonic wires as a part of its return circuit.

There is, as a matter of fact, no interference of electric currents in the ground, as there may be thousands of currents crossing each other in the earth in all conceivable directions, and yet each individual current will preserve its integrity and identity. It is only when a foreign current gets on to a specially prepared path, such as the telephone wire, or, in other words, trespasses upon private property, that disturbances are noticed.

The telephone company does not ask a monopoly of the earth for its return circuit—it merely demands a right to use the earth for such purposes, and concedes the same right to all other electric currents.

It claims that it uses such a current as not to interfere in any way with any other electric currents using the same common return, and demands that if the electric railway uses this same common highway, that it shall do it in such a way as not to interfere with its use by others.

It claims, also, that in this case the electric railway comes in and not only utilizes the common highway—the earth—but actually trespasses upon the private property—the wire—of the telephone company.

As before indicated, the telephone company uses a current in such a way and of such a character that it does not and cannot, in any way, interfere with the use of this common highway—the earth—by any other electric current; it is, therefore, not trespassing on the rights or property of others by so using it.

2d. Static induction. 3d. Dynamic induction. Both of these disturbances are due to action at a distance independent of the earth, but in this case propagated through the air.

The monopoly or use of the earth does not necessarily enter into this question at all, as both classes of disturbance may exist where the latter does not in any way form part of either circuit.

If two wires be near together and parallel, and a steady uniform current of electricity be passed through one, no current or influence can be detected as existing in the other, however powerful the current may be. If, however, this current be caused to vary rapidly in strength, then will electric currents be induced in the second parallel wire, and the strength of these induced currents will be the greater, the greater the variation in strength of the primary current, the nearer the two wires be together, and the greater the distance through which the two wires are parallel. The current used by the electric railroad is necessarily subject to greater and more rapid variations than any other electric current now in use, except the alternating current, and, therefore, is more objectionable than any other power or electric light currents now in use, except the one mentioned.

The telephone company claim that although the current they employ is one of varying strength, yet this variation is so slight as to be detected in no other way than by its own very delicate instruments; that it does not and cannot, in any way, interfere by induction or leakage with any other existing or known electric currents.

It also claims, and it is in evidence, that the electric railway employing a ground or earth return does use a current of such variability as to render the air (another common highway), for considerable distances throughout the length of the road, unfit for the location of telephonic wires—in fact, that the electric railroad using the earth return, monopolizes the earth by leakage and the air by induction for considerable distances throughout the length of the track; and, furthermore, it is in evidence that telephone lines may not even pass through this disturbed pre-empted district without being rendered useless, and also that all other telephone lines not lying within the disturbed district, but which may be, at any time, connected with lines so lying, are also disturbed because of this very connection.

The telephone company claims, and it is in evidence and is admitted, that there are remedies at hand for both of these evils, and that these remedies may be applied by either party; and it is still further claimed, and in evidence, that there is but one remedy, viz, by employing a complete metallic circuit for either or both of the currents.

If the railroad company employ a double overhead system (double trolley), viz, a metallic return instead of the earth, the trouble of leakage, before referred to, cannot exist. In the case of all powerful currents, this leakage may become extremely dangerous, and interfere not only with telephonic but other harmless circuits.

It is also in evidence and admitted that if a metallic circuit be used, and the outgoing and return wires of said circuit take the same route and keep close together, that all inductive effects are entirely neutralized, and disappear. If, therefore, the electric railroad uses a metallic return, and carries that return wire back parallel and near to the "outgoing" wire, it will then leave free for other uses the surrounding air, and inductive effects will disappear.

Other high potential currents, such as electric light currents, although they are, with the exception of the alternating current system, very steady, and, therefore, less capable of producing inductive effects, nevertheless are forced not only to use a metallic circuit by the underwriters, as a necessary protection against fire and danger to life, but also return parallel and by the same route to pre-

vent injury to other lines by induction. The rules of the fire underwriters strictly prohibit the use of the ground by all electric light and power currents, but permit the use of the same by telephonic and telegraphic currents, because they are perfectly harmless.

The telephone company may, indeed, protect itself by making its circuit metallic, and thus, by avoiding the ground, prevent the leakage of its own current—a current so infinitesimally small that its existence cannot be demonstrated in any known practical way—and by bringing its return wire back by the same route, parallel to and near to the outgoing wire, it may shut out the powerful induction of other currents and prevent its own inductive action which cannot disturb any other wires.

In other words, the telephonic current is such that it may use the ground as a return circuit without in any way unfitting it for other uses. The electric railroad cannot so do.

It may also traverse the air on wires without in any way interfering with its use by other electric wires. The electric railroad cannot so do.

4th. If the remedy is at hand to either party, which should be compelled to adopt it?

This has been partly answered. Aside from the question of pre-occupation, the question appears to me to resolve itself into this. Granting that both parties have an equal right to the use of the earth and air (for the air is as much in the question as the earth, though not emphasized by the defense), they only have such right in so far as, by exercising it, they do not interfere with the rights of others.

The question is, if the uses of common highways by both are incompatible, which are the transgressors? The telephone current, which can scarcely be detected, so small is it, or the railroad current, with its 500 or 600 volts, and two or three to a hundred amperes of current?

The telephonic variation in strength, which can be detected only by the telephone itself, and cannot, therefore, produce inductive effects injurious to other instruments, or the electric railroad current, whose variation is often measured by the horse-power?

There can be no question as to which is the transgressor, nor is there a question before the court as to the existence of a remedy.

It is admitted that both parties have a remedy, and if that remedy be practical, the question is, which must apply it—the company whose current is so mild and gentle that its presence would not even be suspected were not recourse had to instruments of the greatest delicacy, or the company that uses a current sufficiently powerful to move at rapid speed tons of weight at a time?

Should the question of practicability of the proposed remedy be raised by the defense, we point to the testimony of experts and the result of actual practice.

If it be said, by experts and others on the other side, that a double trolley system for street railway propulsion is impracticable, and cannot be made to work successfully, we reply, that other experts, equally credible, testify that there is no mechanical or electrical reason why such a system should not work successfully; more than that, we have produced witnesses who state that such systems are now and have been in successful operation not only elsewhere but right here in our midst.

Not only do electrical experts thus testify, but practical railroad men, who should know, if anybody does, what constitutes practical success, pronounce the system a commercial success, and are so well satisfied with it, in every way, that new roads, aggregating 19 miles of single track, are now under contract in our immediate vicinity, based on the success of those already in use.

The defense claim an advantage in traction by passing the current through the wheels into the track, which they would lose if they abandoned the earth as a return, and they placed in evidence a device to prove their claim. This consisted of a light iron or steel bar resting upon two wheels, and so arranged that a current of electricity could be made to pass from one wheel to the bar—through the bar and back again through the other wheel (a route which it could not take in a single trolley car), and though a current exceeding in quantity that usually employed to operate a heavily loaded street car was employed, the gain in tractive force was just one ounce avoirdupois. And this increase was due (as testified to by Mr. Farnum, after a microscopic examination of the bar) to a roughening of the surface due to the excessive current employed.

It is also significant that this same witness for the defense, Ries, would not permit the use of a model by which the conditions existing in street car practice could be exactly duplicated, to be used to test the truth of this claim, although the model could not in any way be injured by such a trial, and he was insured against injury. The device in question was operated to illustrate another feature, one that had no relevancy to the case whatever, as it did not involve the passage of an electric current through the wheels to the track. It was a device that admittedly could be applied to a car operated by double trolley quite as well as one operated by single trolley, and if it had any virtue, might with better grace have been presented by the plaintiffs than by the defendants.

The plaintiffs have proved that the earth return is not necessary to the successful operation of street cars by electricity. They have proved that the double trolley system not only practically overcomes all difficulties in the earth and air, but is an electrical, mechanical, practical and financial success; and the defendants have, to say the least, failed to prove any advantage in the way of traction obtainable by passing the current from the wheels to the rails. It is also in evidence that the Mt. Auburn Electric Railroad uses sand in ascending their steepest grades. If there was anything in their claim, this would be not only unnecessary, but actually bad practice. Practice, therefore, seems to be entirely in accord with theory, that no benefit is derived by thus passing the electricity.

The expense to the defendant to remedy the evils complained of would be covered by the cost of one additional wire extending the whole length of the road, and a few dollars for each car, to erect an additional trolley mast, and make some changes in connections. The motors, generators, and remainder of plant would require no change whatever

On the other hand, should the telephone company be compelled to protect itself by making a metallic circuit, it is in evidence that the number of wires would have to be doubled, the old poles would have to be replaced by larger ones, and the entire equipment of the three exchanges replaced by another.

Furthermore, it is in evidence that the success of the complete metallic circuit switchboard is not assured; that such switchboards are still in the experimental stage.

The only other remedy suggested by the defense is the employment of the so-called McClure system. It is in evidence that this is a remedy only against leakage in the earth; that it does not and cannot in any way clear away the trouble due to induction, which exists at present chiefly in the air. Placing the wires underground does not remove them from inductive influence unless they be doubled also.

5th. The boards of underwriters have unanimously concluded that even the incandescent electric light wires, which usually carry an electro-motive force not exceeding 120 volts, are dangerous to property if grounded, and have decreed that all such currents must be by complete metallic circuit; and the city ordinances (Coppock & Hentenstein, 1887, pp. 296, 297) expressly states: "In no case must ground circuits be employed, or any portion of the system be allowed to come into conducting connection with the earth through water or gas pipes, or otherwise."

It is in evidence that all electric light and power currents are on metallic circuits. This is so, not because the metallic circuit is cheaper, but because it is not safe to let them go into the ground. If, then, insurance men will not permit a current of 120 volts and 1 ampere to go into the ground, why should a current of 500 to 600 volts and 3 to 100 amperes be permitted to do so?

Danger from electricity is only possible when an object—a conductor—touches both sides (the positive and negative) of an electric circuit. If the ground or earth be used for the return, then every article, thing or person on the earth, or in any way electrically connected with the earth, has fulfilled half of the conditions for receiving the full benefit of the current—they are touching one side of the current. If now, by accident or design, they come in contact with the other side of the current, the other half of the conditions is fulfilled. If the current thus touched be such as is employed by the telephone company, no possible danger could result; but if it were the current used by the incandescent light, of from 100 to 120 volts, the board of underwriters have agreed that it would be dangerous to property. How much more dangerous to property and life, therefore, would be the current of the electric street railway of from 500 to 600 volts?

It is evident, then, that the telephonic currents are harmless, and the railroad currents dangerous, per se.

It follows, therefore, that so long as the railroad currents remained grounded—whatever the method employed in transmitting telephonic currents—the former will remain dangerous, but that if by any means they can be made safe in themselves, they will remain safe whether the telephone wires be grounded or not.

It is further apparent that since the telephonic current is per se harmless, no danger can come from telephonic wires, however they may be strung, unless they first come in contact with improperly arranged dangerous circuits.

.... The Green Mountain Telegraph Company was organized at Peru, Vt., January 8. J. E. McNaughton of Barnumville is president, and W. E. L. Walker general manager.

A Remarkable Case of News Stealing in a Mining Town.

In the winter of 1884–5, I was managing editor, city editor and the entire reportorial corps of a little daily paper in a Colorado mining town. Associated press dispatches were out of the question. We had to depend upon the Denver papers, which reached us the same evening, for our telegraphic news, but occasionally the trains got snowed up in the Pass for a week or more, and then we were in a box. On one of these occasions we hadn't had a mail for four days, and things were looking blue.

The town had gas and water works, and a big hotel as reminders of its departed boom, and it also had a telephone line, which connected with another little town 30 miles further up in the mountains, on a branch of the same railroad. The telephone in the station 30 miles away was connected every night with the one in our office before the central office closed, so that in case of an accident in the mines we could get the news.

Several times while using this telephone I had noticed that late at night, when all was still, the clicking of the telegraph instrument in the station up in the mountains could be distinctly heard over the wire. This suggested an idea.

The railroad wire was used as a news wire late at night. If we had anybody with an ear acute enough to read that faint ticking in the telephone instrument, we could learn what was going over the wires. The business manager had been an operator, and a good one, back in the States. He tried the instrument and found that the scheme would work. The next morning we had a column of "specials," including two or three items of Washington news, which were of special interest just then, as every second man in the town was a candidate for some office under the incoming Democratic administration.

The editor of the rival paper rushed to the telegraph office to inquire what it meant. He was told that we had received nothing over the wire. With the train snowed up on top of the Pass, "faking" from the Denver papers was out of the question. Yet there were the dispatches, and unmistakably genuine, too. The wires had been tapped, that was certain, but where, when, how? The railroad people ordered an investigation, but discovered nothing. Nobody thought of the clicking instrument in the closed railroad station 30 miles away, and the marvellous carrying power of the telephone in that clear, still mountain air.

Our brother editor on the rival sheet thought it was a "dead, cold fake," but he was afraid to say too much about it, as he had run out of paper and we had him at our mercy, at least until a train got in. Of course, the secret was jealously guarded in the office, but the "specials" were kept up until the train got through. Then we quit. The business manager was a conscientious man and didn't believe in stealing news when it could be obtained in any other way. Besides, he objected to the work.—*N. Y. World.*

Another Use for the Phonograph.

The *Pall Mall Gazette* says: "An interesting physiological experiment was made at the Edison House, the headquarters of Edison's Phonograph Company in Europe, last week. Dr. L. White, of Harley street, has a patient who has a defect in his speech of a most singular character. The patient, a lad of ten, and English by birth, is unable to speak his native language but a jargon which cannot be understood; many doctors have examined him, but could not exactly diagnose the cause of the phenomenon, and it was questionable whether the lad spoke the same thing twice in the same way, and the only way to discover whether he did so or not was to get him to speak to the phonograph. The lad, in the presence of several gentlemen, was asked to speak the Lord's Prayer and the alphabet. Several cylinders were made in this way, and when a comparison was instituted between the various phonograms, it was found that there was no variation in the spoken words and that it was quite possible for the language which the boy speaks to be understood by simply learning the various sounds. The phonograms will be exhibited before various societies in this country, and it is just possible a new disease has been discovered."

TELEGRAPHIC

.... There is beauty in the bellow of the blast,
There is grandeur in the blowing of the gale;
There's a solace quite aesthetic
In the lightning so poetic,
In connection with a wire and a rail.—*Minneapolis Times.*

.... The Postal Telegraph Company have been placing some very large and high poles through Hartford, Conn. The telegraph company gains a new through line to Boston.

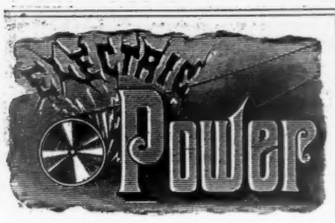
.... The construction force which is building the line of the Postal Telegraph Company from Fayetteville, N. C., to Wilmington, is within a few miles of the city. They are building a first class line and will have it completed in about a week. Two wires are being strung.

.... It is stated as an interesting matter of history, that had the electric telegraph been in existence in 1814, the great battle of New Orleans would not have been fought, as the treaty of Ghent had been concluded fifteen days previous, on December 24, 1814. The news of this treaty of peace did not reach Washington until a month after the battle took place. Another interesting matter in connection with this is, that had the battle of New Orleans not been fought, Andrew Jackson would not have been famous.

... The "Universal Electric Railway Signal Company," 1103 East Main street, Richmond, Va., exploits the invention of W. C. Walter, which, on paper, enables railroad locomotives, approaching each other on single track, to automatically signal each other. A three-quarter inch iron rod, laid between the rails and insulated by vulcanized fibre blocks, wire contact brushes, an electric bell and battery on each locomotive, with the addition of a telephone to pass the time of day—who wouldn't be an engineer on such a road?

.... The Canadian Pacific Railway Company's line of telegraph was completed at Halifax, a few days ago, and the Halifax office opened for business. The advent of the C. P. R. telegraph was hailed with delight, not only by the business community but more especially by the government and the press. Heretofore all government official business has been under the control of the Western Union Telegraph Company, of New York, which, during the fisheries dispute between the Dominion government and the United States, might have been a matter of serious concern. The press news supplied to the Maritime Provinces papers has also been compiled in Boston, making newspapers dependent on American sources for not only their European but most of their Canadian news.

.... Matters are booming in Commercial Union Telegraph circles. They are building two new lines, of four wires each. One from Boston to Newburyport, along the line of the Eastern Division of the Boston and Maine Railroad through Salem, Lynn and other towns, and one from Albany, N. Y., to Boston, the eastern end of which line is just completed. A third wire is being run from Portland to Lewiston. The final link was completed Sunday, which connects the Commercial Union with the Canadian Pacific and gives them two lines to New York, St. Louis, Chicago and Minneapolis, one by the way of Halifax, the other by the way of Portland. In the spring the company will run two wires to Bar Harbor and two to Belfast, Rockland and Bath. The latter will be placed near the Knox and Lincoln Railroad. A line is also to be built northward from Concord, through the White Mountains.



* * Twelve new buildings are to be added to the big Edison plant at Schenectady. All the machinery is to be run by electricity.

* * The Norfolk, Va., Electric Light and Power Company has amended its articles of incorporation so that the capital stock is increased to $25,000, shares $50 each.

* * The electric road between Waterloo and Seneca Falls, N. Y., will be put in operation in May. It is reported that the property has been bought by the Thomson-Houston Electric Light Company.

* * The management of the electric railway systems of Davenport, Ia., Stillwater, Minn., and Dubuque, Ia., have been consolidated. The general office of the company will be located at Davenport, where the in corporators reside.

* * The new electric motor car for mining purposes, recently put upon the market by the Jeffrey Manufacturing Company, of Columbus, Ohio, is capable of making a speed of 8½ miles per hour, hauling a load over a 4½ per cent grade.

* * There has been organized among the scientific students of the senior and junior classes at Rutgers College an "Electric Society" for special study of engineering and for the encouragement of manual skill and a preference for mechanical work.

* * The John T. Noye Manufacturing Company, of Buffalo, has recently opened an office at 89 Liberty street, New York. Mr. Albert Fisher, a capable mechanic and engineer, is in charge, and will attend to all sales of the Rice automatic engine, and steam engineering generally for this territory.

* * A new electric line will be constructed in Kansas City, Mo. The franchise was granted last June. The stockholders are William S. Woods, O. F. Page, Henry Harper, T. J. Green, L. E. Davison, H. M. Meriwether, David Waldo, Gilmer Meriwether and Thomas H. Edwards. The capital stock is $100,000.

* * The Electric Piano Company, of Boston, Mass., in its prospectus, says: "About 90,000 pianos are made and sold annually in the United States, and it is estimated that there are now in use about 1,000,000 instruments. The people interested in this company believe 500 electric attachments can be sold the first year."

* * The new Cog Wheel Railroad, from Manitou to the summit of Pike's Peak, is nearly graded, and the road will be in operation about June 1. The distance is eight miles, and will be lighted by electricity, by means of a marine projector on the summit. Mr. Wm. Long has the contract, and the American system will be used. It will be run by water power, in connection with the present Iron Springs Company's plant.

* * Some very radical changes are being made in the power at the station of the Citizens' Light and Power Company, Burlington, Vt. A new 200 horse-power compound condensing engine is being added, as well as new special meter wheels. When this work is completed, which will be about February 1, the station will be one of the best equipped in the State, and the company will be in position to take the large amount of new business which awaits them.

* * On the 17th of January, the Jenney Electric Motor Company was incorporated at Indianapolis, Ind., with a capital stock of $35,000. The incorporators are Addison Bybee, Julius F. Pratt, Chas. D. Jenney and Edwin W. Jenney. This company succeeds to the business of Chas. D. Jenney & Company, and will carry on the manufacture and sale of electric motors and other electrical machinery. The manufacturing will be continued at the present location on South Illinois street, where machinery is being added, and the space more than doubled.

An Instance of Electrical Development.

There are few more remarkable instances of the rapid growth of the electrical industries of this country than that given by the Standard Underground Cable Company, of Pittsburgh, New York and Chicago; this company, which makes a specialty of underground cables for electric light and power, telephone and telegraph and other classes of electric service, has had to twice double its manufacturing capacity within the past 12 months—in the first instance by adding two additional stories to its main building, and again by building a new factory adjacent to its old works—and even now, with its improved methods for the manufacture of its specialties, it is, and has been for several months, compelled to run night and day to keep pace with its increasing orders.

Within the past seven months the Standard Company has laid, in New York City alone, over 1,500,000 feet of lead covered electric light and power cable, the sizes ranging from No. 6 B. & S. G., to 400,000 circular mils, and over 5,000,000 feet of conductor for telegraph, telephone, electric bell, burglar alarms, and other kinds of electric service, and also many hundred miles of its improved aerial line and house wires. But the Standard Company has not confined its efforts to the East alone; it has not only taken Horace Greeley's advice and "gone West," but has also gone North and South, and into Canada and many foreign countries, and the large number of names to-day on its order book at its main office, in Pittsburgh, and the busy and unceasing din of its factories, attest its success.

We hope the Standard Company will enjoy its phenomenal success, for surely the pluck and enterprise displayed by this company is worthy the high reward it is receiving.

Mecca of the South.

The special personally-conducted Pennsylvania Railroad Florida Tours have formed the theme for so many conversations with those who have, through their medium, visited the South's Mecca, as well as others now contemplating the trip, that their familiarity with the travelling public simply makes it necessary for the company to announce the date of each departure to insure the "special's" limit, 150 persons.

The luxury of travelling in a train composed of Pullman vestibule, sleeping, drawing and dining cars, with the watchful and constant attention from the accompanying tourist agent and chaperon, meals *en route* in both directions free, from a *cuisine* renowned, and the privilege of a two weeks' sojourn South included in the $50 price of tickets from New York, and $48 from Philadelphia, needs no comment, so liberally does it appeal to lovers of comfort and luxurious travel. The second tour left New York January 21, and upon its arrival at Jacksonville, the sun-bronzed passengers of the first tour will board the train for home. The departure of the third of the series is fixed for Tuesday, February 4, a time of the year when southern travel is heaviest. Itineraries, details and all information, can be had at the Pennsylvania Railroad ticket offices, or by direct communication with S. W. F. Draper, tourist agent, 849 Broadway, New York.

A Good Risk.

"Any applications for policies?"

"Yes. Here's a fellow who's sentenced to death by electricity wants a 10-year policy on his life."

"Oh, take it. It's a safe risk."—*Life.*

Annual Meeting.

The annual meeting of the Edison General Electric Company was held last week, and the following named gentlemen were elected directors: Thos. A. Edison, C. H. Coster, J. H. Herrick, Samuel Insull, E. H. Johnson, Joseph S. Decker, A. Marcus, Carl Schurz, Francis S. Smithers, Henry Villard and J. Hood Wright. It is supposed Mr. Villard will be elected president of the company, although officers were not elected at the meeting.

* * The citizens of Marlboro and Hudson, N. Y., are much interested in the matter of an electric railway which shall connect the two towns. The Marlboro Electric Street Railway Company, having this scheme in view, has petitioned the Legislature for authority to increase its capital stock to $100,000.

OUR ALBANY LETTER.

[Special correspondence of the ELECTRICAL REVIEW.]

ALBANY, January 22.—In the Senate, to-day, Senator Erwin offered the following resolution:

Whereas, The employment of electricity for lighting and power purposes may become of vast public interest, and numerous corporations and persons in various cities and towns in this State are engaged in the business of generating and distributing electricity for lighting and power purposes, and using to a considerable extent, in connection with their said business, the highways and public places in such cities and towns, thus rendering the business of more than usual interest and importance to the public; and, *whereas*, the business as heretofore conducted has been the cause of considerable loss in life and property, and it is a matter of great public importance and interest to determine how the danger to life and property may be remedied; and, *whereas*, there has been developed an unmistakable demand on the part of the people in the State that said business should be investigated by the Legislature, and such an investigation has been called for by the public press, and by the grand jury for the city and county of New York, for the month of December, 1889, which, by a formal presentment, recommended that the Legislature shall, without delay, appoint a committee of its members to inquire into the subject and report upon a plan of legislation designing to prevent further danger from electrical apparatus;

Resolved, therefore, that the committee on general laws of the Senate be, and hereby is, authorized to investigate the methods employed in furnishing electricity for light and power as now conducted in this State, and such other matters as are connected with said business, and report to the Senate, before April 1, 1890, such recommendations as the committee may deem proper for the information of the Senate, in framing legislation necessary for public safety.

January 23.—Assemblyman Kerrigan to-day introduced the following bill, relative to the Consolidated Telegraph and Electric Subway Company, New York. "On and after the passage of this act, the rental of ducts for the reception of wires underground in the main subway, and for subsidiary or distributing ducts and wires shall be fixed by the board of commissioners of the sinking fund."

In the Senate, to-day, Senator Erwin called up his resolution of yesterday, regarding the investigation of electric light and road companies, and amended it by dispensing with an expert and leaving only a stenographer to be employed by the committee.

Mr. Ives asked that the investigation be placed in charge of the committee on judiciary.

After further remarks from Mr. Edwin and Mr. Sloan, Mr. Ives' amendment was lost, and the resolution was adopted by a vote of 18 to 9.

Senator Sparta, introduced in the Senate, to-day, a bill already introduced in the Assembly to allow the Seneca Electric Railway to use electricity instead of steam on its line.

The following is from the report of the Railroad Commissioners, transmitted to the Legislature January 13th:

CHANGE OF MOTIVE POWER FOR STREET RAILROADS.

"A statute was passed last winter substituting the Board of Railroad Commissioners for the local authorities of cities or villages, as the public authority to give consent for change of motive power by street railroads.

"Numerous applications have been made to the board, and much time and attention has been devoted to the investigation of the merits of the change in each particular case. Your attention is drawn to the decisions of the board in the application of the Third Avenue Railroad, of the city of New York, for the approval of a change of motive power from horses to cable, and those of the Utica Belt Line, and the Troy and Lansingburgh Railroad Companies, for the change from horses to electricity. The application of electricity, either by storage batteries or by transmission by overhead wires, has been greatly perfected within the last year. The method by storage batteries within the cars has many obvious advantages. Each car is independent and under the complete control of the brakeman. It appears to be somewhat expensive, however, and not well adapted to roads with continuous steep grades. The overhead trolley system has been put in operation in a number of cities of the State. It appears to be working satisfactorily. There are certain dangers and objections to it, however, which should be carefully considered before it is adopted. The board repeats its language used in the case of the application of the Utica Belt Line Railroad Company: A tremendous energy is invoked; the cars are enabled to run at a very high rate of speed, and certain dangers undoubtedly occur that should be carefully guarded against, and city authorities should see to it that a higher rate of speed than that consistent with safety to the street traveller should not under any circumstances be permitted; that at least two men should be put on every car, viz: A brakeman or driver, and a conductor. No car propelled by electricity should be permitted to run with less. The erection of poles, too, with the transverse wires, to a greater or less extent impairs the use and appearance of the streets, and the railroad company should be required to erect sightly poles, and high enough to permit all vehicles to pass with their loads under the wires stretched across the street. In the application of the Troy and Lansingburgh Railroad, it was developed that the high tension currents of the railroad company seriously interfere with the delicate currents on the wires of the telephone companies, either by leakage, *i. e.*, conduction, or by induction in consequence of the proximity of the wires of the railroad company to those of the telephone company. The statute provides that, in addition to the approval of the Board of Railroad Commissioners to change of motive power, the consents by the owners of one-half in value of the property bounded on that portion of a railroad as to which a change of motive power is proposed, shall be obtained, or, in case the consent of the property owners cannot be obtained, then the determination of three disinterested commissioners appointed by the General Term of the Supreme Court, confirmed by said court, shall be taken in lieu of the consent of said property owners. The board has made it a condition precedent to its approval, that the consents of the abutting property holders should first be obtained. A case of appeal to commissioners appointed by the court has not as yet come before the board." H. L.

The French Submarine Boat that Works.

A correspondent of the *Temps* sends from Toulon an account of experiments made last week by the submarine gunboat the "Gymnote," from which, as it refers to a subject which has attracted considerable attention in England, the chief passages may be quoted:

"This small vessel has the form of a narrow spindle. It is 17 meters 20 centimeters long by 1 meter 80 centimeters in diameter, just the height necessary to stand up in the interior. It weighs 30,000 kilogrammes, and its motive power is an electric 55 horse-power machine, made from the plans of Capt. Krebs, and worked by accumulators. This motor puts a screw in movement. The 'Gymnote,' at the close of 1888, underwent trials which were quite successful from a nautical point of view, but it was then admitted that it was indispensable to modify the accumulator cases in order to avoid waste of electricity. After patient researches, fragile non-conducting substances being set aside, cases were at length produced which have given entire satisfaction, made of a gutta-percha prepared by one of our manufacturers. After having made (last week) a preparatory trip to ascertain that all was working properly on board, and taken some very satisfactory plunges, the 'Gymnote' re-entered the harbor, and her accumulators were charged. At noon of the second day she was made ready by hermetically closing the panel giving admission to the interior, which was not to be opened till four hours later. * * * * * * * *

"The 'Gymnote' was accompanied by a steam launch which had instructions to keep out of the way any boats which might come up. On getting to the place selected for the trials everything was put in order for the plunge. Then, when all was ready, on an order given by the commandant, Naval Lieutenant Baudry la Cantinerie, the boat was set in motion by gently working the horizontal rudder. The vessel bent down in front, descending slowly. Soon nothing could be seen but a paddle and a portion of the screw above water. Then all disappeared. It had been arranged beforehand that the boat should stop at about 2 meters 50 centimeters below the surface of the water. It was found easy to remain there with variations of about 20 centimeters. As regards direction, the gyroscope gave it with mathematical precision. The length of the course was estimated by the number of turns of the screw, and in this way it was known when the limit of the deep water was reached.

"The 'Gymnote' next returned to the surface, passed round a mark, and took a plunge in the opposite direction. At half past three the Maritime Prefect came to be present at the trial. The 'Gymnote' awaited him on the surface of the water. As soon as she saw the Admiral's steam launch she plunged again under water and took three runs, prolonging her course as far as the depth of water in the roads would permit. She remained more than 10 minutes under water. The 'Gymnote' does not leave on the surface any trace of her passage, and is quite invisible when painted gray. On this occasion a coating of white paint had been given her, so as to permit of her course being seen under the water. * * * A little after four o'clock the 'Gymnote' returned to the Vauban dock, and the air in the interior was as easily breathed as at her departure. There was still electricity enough in the accumulators to last for hours."

Glass Tubes for Conduits.

A company representing a capital of $500,000 has been organized at Penderton, Ind.

For several months this company has been experimenting at the Penderton Glass Works in regard to a method of constructing glass tiling or tubes for use of underground wires.

Its factory will be the only one of its kind in the world.

Consolidation of Important Interests.

An important consolidation of electrical interests took place a few days ago in Pittsburgh, Pa.

At a joint meeting of the stockholders of the Keystone Construction Company, the Marr Construction Company and the Washington Carbon Company, it was decided to amalgamate the interests of these concerns and call the new organization the North American Construction Company. The new company went into effect on January 21, with head offices in the Westinghouse Building, Pittsburgh.

The officers of the North American Construction Company are James S. Humbird, president; F. S. Marr, vice-president and general manager; H. M. Doubleday, general superintendent, and E. H. Wells, general agent.

The company will do exploiting and electric construction, both for central stations and railway work, and also build, lease and operate central station plants.

The Marr Construction Company has been in existence for six years, being originally organized to do the construction work for the Edison Electric Company. About four years ago, however, the company commenced to do construction work for the Westinghouse Electric Company. The Keystone Construction Company was established a few years ago as an adjunct of the Westinghouse Electric Company, for which it has done the construction work ever since. The Washington Carbon Company was organized by Mr. J. S. Humbird, about a year ago, for the purpose of manufacturing carbons for general electric use.

The new company employs about 400 men and has a capital stock of $500,000.

—— At the annual meeting of the Manchester, N. H., Electric Light Company, the following board of directors was elected for the ensuing year: W. L. Elkins, Jr., Hon. James A. Weston, John B. Varrick, H. E. Parker, Hon. J. C. Moore, Alonzo Elliott, J. W. Hildreth, Frank Dowst and Walter G. Africa.

—— The Suburban Light and Power Company, of Boston, has leased the building on Howard street, Roxbury, formerly used by the Globe Nail works as a rolling mill. It is of brick, 175x76 feet, and contains a 600 horse-power engine. The company's contract with the city calls for about 800 lights, and the facilities in this building are said to be ample for a number far in excess of that for which the contract provides.

—— The annual meeting of the stockholders of the Nashville, Tenn., Electric Light and Power Company, resulted in the election of the following board of directors: Wm. M. Duncan, Wm. Porter, B. Lanier, J. H. Yarbrough, R. L. Morris, T. L. Herbert, Max Sax, John M. Gaut, Albert Roberts. After adjournment the directors met and elected R. L. Morris, Esq., president and manager, and E. W. Hooper, secretary and treasurer.

—— The Nationalist Club, of Boston, Mass., are circulating petitions throughout the commonwealth, which are to be presented to the legislature, of which the following is a copy: "We, the undersigned citizens of the commonwealth, respectfully petition your honorable body for the passage of a law permitting cities and towns to manufacture and furnish gas and electricity for the use of the inhabitants, by the purchasing of electric plants, or by the establishment of new ones; thereby securing, in the case of water works, cheaper and more satisfactory service, to the end that all the people may reap the benefits and profits arising from such public necessity."

—— The stockholders of the Consumers' Electric Light and Power Company, Batavia, N. Y., at a meeting held last week, decided to increase the capital stock of the concern from $25,000 to $50,000. This step was rendered necessary owing to the great increase in the company's business. A new style of arc dynamo, which the Westinghouse Company are to manufacture, is to be secured. The new dynamos are said to be a great improvement on any that have been made yet. The armatures are non-destructible, the carbons last two days instead of one, the lamps can be adjusted so that any desired power can be furnished, and any light can be turned out at any time without interfering with the others, the same as incandescent lamps.

An Insulated Screw Eye.

The illustrations shown on this page give a good idea of a very neat and useful little contrivance just put upon the market by the Seely Manufacturing Company, 14 Cortlandt street, a new electrical company recently organized in this city.

Fig. 1 represents the screw eye, which is covered with an insulating material that prevents all loss by leakage. The loop is spread open so that the advantages of a hook are combined with the screw eye. It is gimlet-pointed and so made that it may be screwed into wood simply with the hand.

Figs. 2 and 3 show its use in inside work.

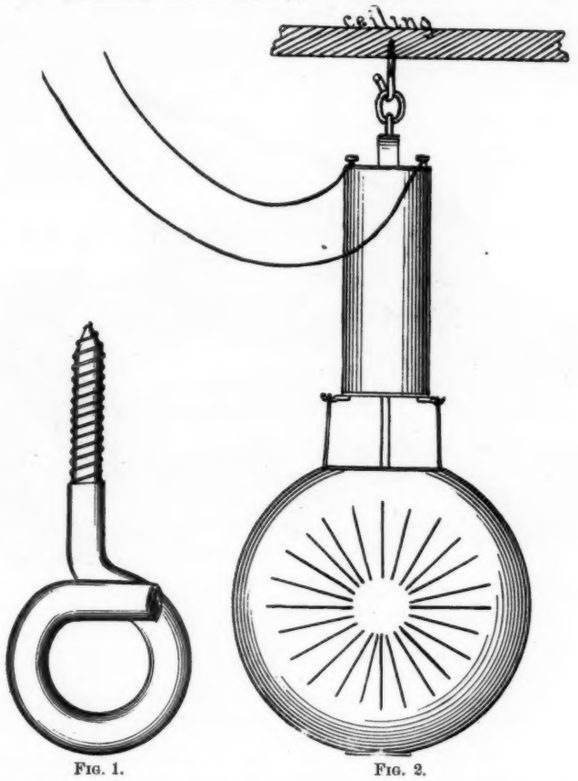


Fig. 1. Fig. 2.

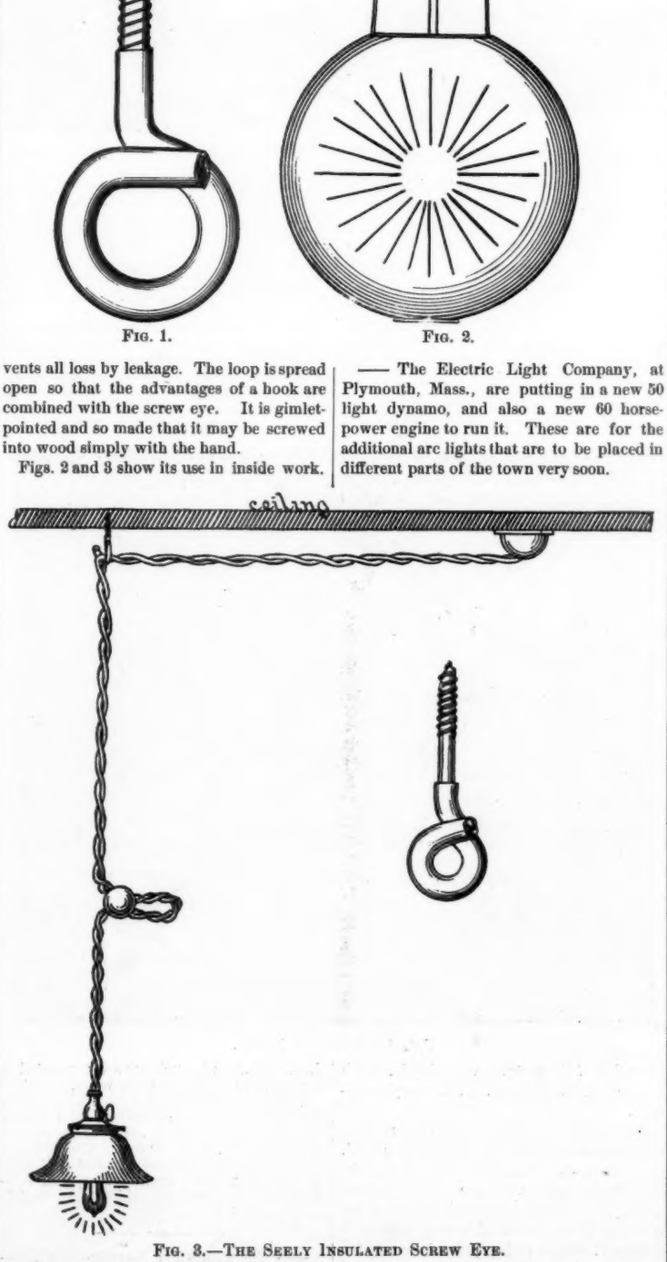


Fig. 3.—The Seely Insulated Screw Eye.

A heavy arc light may be suspended from it or a flexible cord may be carried along the ceiling. These screw eyes are made in sizes desired.

—— Belvidere, Ill., will establish an electric light plant. The central station will be equipped with Westinghouse alternating apparatus with a total capacity of 750 lights.

—— The Westinghouse Electric Company, whose main plant has been located in the center of Pittsburgh, Pa., has decided to locate at Brinton, near Pittsburgh, where a large plant will be erected.

—— The Electric Light Company, at Plymouth, Mass., are putting in a new 50 light dynamo, and also a new 60 horse-power engine to run it. These are for the additional arc lights that are to be placed in different parts of the town very soon.

—— The Media, Pa., Electric Light Company will extend its wires to Moylan and Wallingford. The outlook for the company is very good.

ELECTRIC LIGHT NEWS

—— The city of Bluffton, Ind., will soon be illuminated by the Thomson-Houston system.

—— The Marion Steam Shovel Company, of Marion, Ohio, have purchased a 25-light Schuyler arc plant.

—— Washburn, Wis., is to be lighted by electricity, and the plant is to be put in at once. The cost of the plant will be about $20,000.

—— The Aluminum Bronze and Copper Company, Bridgeport, Conn., have been running eight hours a day for a several days back.

—— A powerful new dynamo was placed in the electric light station at South Framingham, Mass., last week. It is for incandescent lights, and is the largest yet put into the station.

—— The Hays City, Kan., Electric and Illuminating Company met last week and made final arrangements with the Thomson-Houston Electric Light Company to light the streets of the city.

—— But two roads in the United States are using the electric head-light, the Vandalia and the I., D. & S. The Pennsylvania system endeavored to secure the exclusive right to its use, but was unsuccessful.

—— The Angola Schuyler Electric Light Company, Angola, Ind., started its plant on Monday night last week, and the advent of electricity created great excitement in the little town, and the entire stock of the company was immediately subscribed.

—— Olean, N. Y., Electric Light Company has elected the following officers: President, Dr. J. V. D. Coon; vice-president, W. M. Irish; secretary, A. Williams; treasurer, F. L. Bartlett. The dividend declared for the past year was six per cent.

—— The citizens of the little town of Vailsburg, N. J., waxing impatient at the delay of the town authorities in introducing the electric light, called a mass meeting, passed around the hat and collected $400, or a sufficient amount to light the town for three months.

—— It is stated that the four largest dynamos in the world are being constructed at Siemens and Halske's works at Charlottenburg, Germany. They will be installed in the two large central stations in Berlin, and will be 1,000 horse-power each, and have a capacity of 10,000 lamps.

—— The Electric Light Company at Somerville, N. J., has been instructed by the Bound Brook Board of Street Commissioners to proceed at once with the work of putting up the balance of the street lights. There are now 22 lights in operation, and 16 more are to be added to the circuit.

—— Prof. Thomas French, of the University of Cincinnati, recently advocated underground construction, in a report. He has revoked his decision, and admits that it is difficult to conceive which is the most to be feared, the unknown mysteries concealed beneath, or the known dangers overhead.

—— The Northwestern Electrical Supply and Construction Company, of Seattle, Wash., have recently furnished the Ellensburg Electric Light and Power Company with a Thomson-Houston plant. The steam plant, which is of 100 horse-power capacity, is furnished by the Ball Engine Company, of Erie, Pa.

—— At the annual meeting of the stockholders of the Brockport Electric Company the following were elected: Trustees, F. H. Leonard, Jr., L. T. Underhill, D. C. Freeman, R. J. Cook, D. S. Morgan, George D. Morgan and H. N. Beach; president, George D. Morgan; secretary, H. N. Beach; treasurer, D. C. Freeman.

KINDRED INTERESTS

The Schuyler Company is doing good work, and its plants are giving good satisfaction in all directions.

The Empire City Electric Company is rapidly taking front rank among electrical dealers and supply houses, and its roomy Dey street offices present a busy scene every day.

The Central Thomson-Houston Company, of Cincinnati, are putting in a complete electrical plant for the De Coppet Ice Company, of Somerset, Ky. The steam plant is furnished by the Ball Engine Company.

The Haverhill, Mass., Electric Street Railway Company, have just installed a 125 horse-power Ball engine, sold them by C. R. Vincent & Company, 15 Cortlandt street, New York City, agents of the Ball Engine Company.

The Brooklyn Street Railway Company, of Cleveland, Ohio, have just installed two 125 horse-power engines, making 14 engines of this size now in their two power stations in the last eight months. These engines are built by the Ball Engine Company, of Erie, Pa.

The Eclipse Wind Engine Company, Beloit, Wis., have been kept running night and day for more than a year, and so great has been, and still is, the demand for friction clutch pulleys and couplings, stands, shafting, rope sheaves, etc., that the company is now extending both its foundry and machine shop, and is receiving new machinery to increase its facilities, that it may be enabled to fill orders promptly.

The Jewell Belting Company.—The electric lighting companies that have tried the belts manufactured by this company have found them in every instance satisfactory. The Jewell Company is one of the oldest and most successful in the field, and with true enterprise has realized the rapid development that is going on in the electric lighting and electric power branches of the electrical industry. A recent order which they received was for a 37-inch belt about 100 feet long, which order is to replace a link belt which had been running about six months, but which had broken several times and caused the change to be decided upon.

The Thomson-Houston Electric Company reports the following sales of arc apparatus for central stations: Providence, R. I., 50; Anniston, Ala., 50; Ocala, Fla., 50; Cloversville, N. Y., 150; Fall River, Mass., 25; New York, N. Y. (Manhattan Company), 100; Charleston, S. C., 90; Brooklyn, N. Y. (Citizens' Company), 45; Norwich, Conn., 45; Erie, Pa., 60; Norfolk, Va., 30; Seymour, Conn., 30; Delphos, O., 85; Lebannon, Md., 70; Chambersburg, Pa., 70; Washington Court House O., 50; Lincoln, Ill., 35; Dixon, Ill., 25; Jacksonville, Ill., 75; Grand Island, Neb., 50; Dubuque, Ia., 100; Omaha, Neb., 100; Mt. Clemens, Mich., 30; Sheboygan, Mich., 30. The same company reports the following sales of incandescent apparatus to central stations: Dover, N. H., 650; Norwich, Conn., 1,300; Lebannon, Ky., 650; Attica, N. Y., 650; Cynthiana, Ky., 650; Dedham, Mass., 1,300; Gloversville, N. Y., 650; Long Branch, N. Y., 650; Jacksonville, Fla., 1,300; Mt. Clemens, Mich., 650; Santa Rosa, Cal., 650; Watsonville, Col., 300; Redding, Cal., 300; Hermonville, Mich., 650; Naperville, Ill., 300; Dixon, Ill., 650; Marshalltown, Ia., 500; Ashland, Neb., 300; Wilmington, Ill., 500; Waterloo, Ia., 650; Wichita, Kan., 650.

Electric Locomotive for Metal Mines.

We illustrate a new electric rotary diamond drill, manufactured by the Sprague Electric Railway and Motor Company, of New York, which has shown very gratifying results in the tests to which it has been put, and which promises to fill a long felt want in electric mining. Also, we illustrate another special electric mining application, *i. e.*, the electric locomotive. This locomotive is simple, powerful and compact, and is built with special reference to the arduous duties required of such a machine.

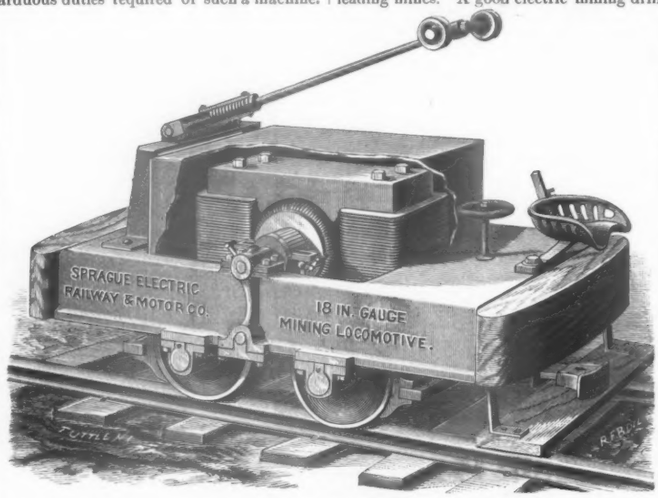


FIG. 1.—ELECTRIC MINING LOCOMOTIVE.

The gauge of the accompanying locomotive is 18 inches, but it can be accommodated to any gauge in ordinary commercial work. In order to protect the machine from damage, all the working parts are completely boxed in, as shown.

The speed of the motor is under complete control, by a switch which throws down the winding of the field into different electrical combinations, thus varying the speed of the motor without the use of any wasteful resistance. The direction of rotation is also governed by the same switch, so that the operation of the motor is very simple, and it can be put in charge of an ordinary workman.

Any system of conveying the current from the dynamo to the locomotive can be used, either using the rails as one side of the circuit for the return of the circuit, or else employing a complete metallic circuit by the use of a double overhead trolley wire. In this latter case, a trolley pole, shown in the view, carrying at its upper end two trolley wheels for making running contact with the overhead wires, is attached on the rear of the locomotive car.

This mining locomotive is now being manufactured by the Sprague Electric Railway and Motor Company, from designs made by Mr. I. E. Storey. One of the most noticeable advances made in modern mining science is the adoption of electricity as a medium for transmitting power and producing light, and such applications as the above indicate not only the growing demand of mining companies for just such apparatus, but the ability of the leading electric companies to supply the need.

The rotary drill has shown very good results in experimental work, and will soon be applied to regular mining work in several leading mines. A good electric mining drill has always been desired by miners. This one is light, compact, simple and easy to operate. The motor is completely encased, so that it is impossible for dust, dirt or stray stones, to lodge in the working parts. The whole drill is mounted on an adjustable frame so that it can be very easily set in any position desired, or set at work at any part of the mine.

The current for operating the drill is supplied at a constant voltage or potential; the number of volts depending on the potential used for transmitting power throughout the mine. If lamps are needed, they can be supplied with current from the same main current wires which supply current to the drill, and when in such use are connected in multiple arc across the main wires.

FIG. 2.—ELECTRIC DRILL.

These drills are manufactured and sold by the Sprague Electric Railway and Motor Company, of New York, also under patents granted to Mr. I. E. Storey. The Sprague Company is now at work on, and will soon be able to furnish, a number of special mining applications, among which is an electric percussion drill.

—— The Cambridge Electric Light Company, beginning February 1, will supply the electric lights on the Cambridge side of the West Boston and Craigie bridges, heretofore operated by the Boston Electric Light Company.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON JANUARY 21, 1889.

419,618 Electric railway system; Thos. E. Adams, Cleveland, Ohio.
419,633 Galvanic battery; William Burnley, North East, Pa., assignor of two-thirds to Charles A. Hitchcock, same place, and Samuel A. Davenport, Erie Pa.
419,642 Insulator for electric wires; Isaac P. Cornog, Philadelphia, Pa.
419,645 Telephone circuit and apparatus; John N. Culbertson, Buffalo, N. Y., assignor to American Bell Telephone Company, Boston, Mass.
419,660 Electric commutator. 419,661 Dynamo or motor. 419,662 Electric commutator. 419,663 Method of producing alternating electric currents. 419,664 Alternating current motor regulator; Ludwig Gutmann, Fort Wayne, Ind.
419,673 Electrical railway system; Thos. R. Hicks, Detroit, Mich., assignor by direct and mesne assignments to the Electrical Invention Company, of Michigan.
419,674 Shield or protector for electric conductors of combined gas and electric fixtures; John C. Hollings, Boston, Mass.
419,709 Electric railway system; Charles Richter, Camden, New Jersey.
419,710 Electric protective system; Arthur C. Robbins, Brooklyn, N. Y.
419,727 Method of treating secondary battery plates. 419,728 Electrode for secondary batteries; Charles Sorley, New York, N. Y., assignor to the Anglo-American Electric Light Manufacturing Company, of West Virginia.
419,730 Galvanic battery. 419,731 Portable Faradic battery; Lucius T. Stanley, Brooklyn, N. Y., assignor to the Stanley Electric Company, Philadelphia, Pa.
419,733 Cut-out; Charles B. Story, Brunswick, Maine.
419,740 Electro thermal current regulator; Frank C. Wagner, Ann Harbor, Mich.
419,753 Electric locomotive; William H. Darling, New York, N. Y., assignor of two-thirds to Geo. Bock, Jr., and Gardner P. Harrington, both of same place.
419,766 Electric door opener; Ado. Glaeser, Brooklyn, N. Y.
419,771 Overhead contact and switch; Robert W. Hawkesworth, East Orange, N. J.
419,774 Galvanic battery; William E. Irish, Cleveland, Ohio, assignor to the Irish Electric Company, same place.
419,776 Electrical clock; Ansel R. Jones, Cleveland, Ohio.
419,808 Electric motor; Le Roy S. White, Waterbury, Conn.
419,829 Electric lamp; Sam B. Cobb, Chicago, Ill.
419,841 Electric railway; Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place.
419,861 Electric reciprocating tool; Harry N. Marvin, Syracuse, N. Y.
419,862 Secondary battery; Jacob F. Mehren, Chicago, Ill.
419,923 Electrical conductor; Hiram H. Carpenter, New York, N. Y.
419,962 Insulating pipe joint; George W. Lane, Asbury Park, New Jersey.

WANTED.—A responsible party in New York to dispose of bonds on the Electric Air-Line Transportation and Musical Telegraphy for Concert Purposes, and for the World's Fair. Vide: ELECTRICAL REVIEW, Jan. 4, 1890, and published Proceedings of the U. S. Central Commission for 1872, Appendix 3, Pages 92-3.

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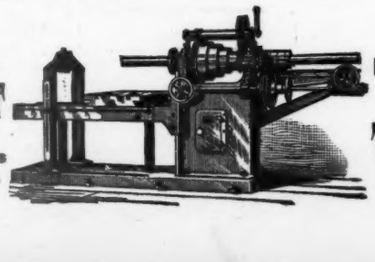

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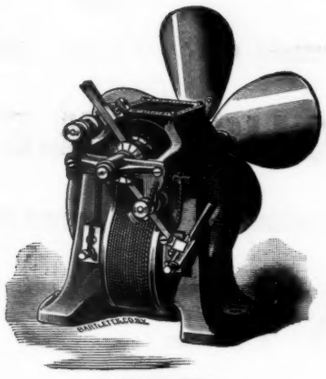

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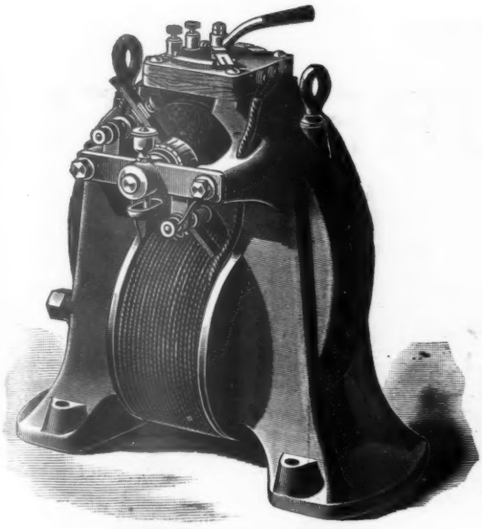

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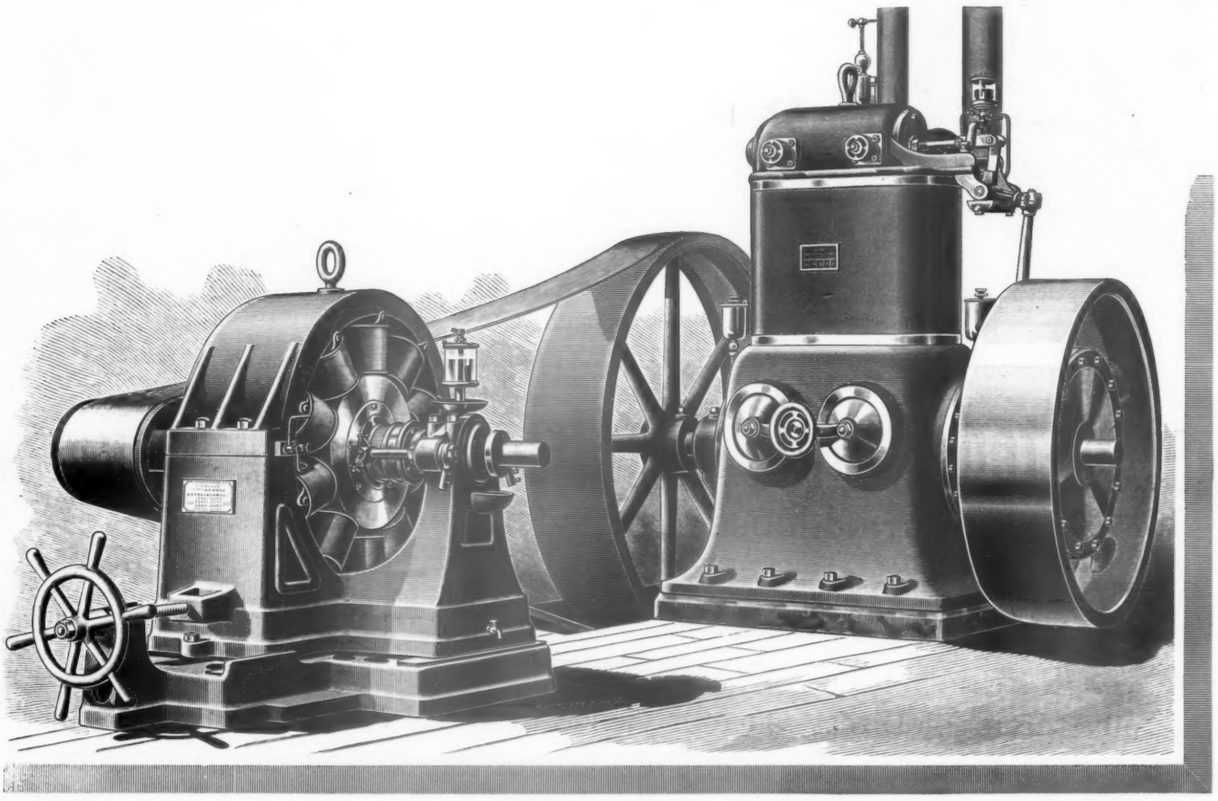

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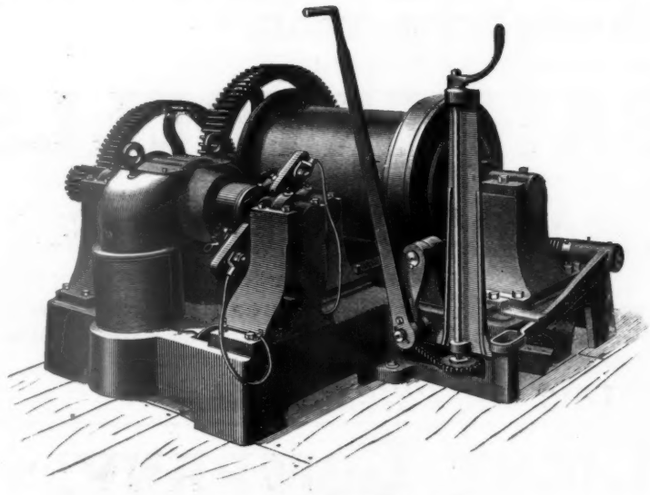

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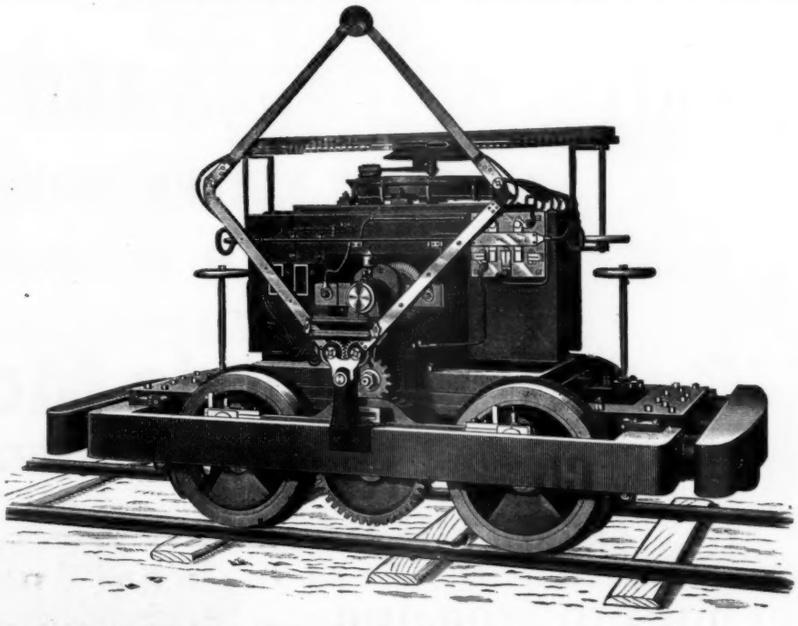

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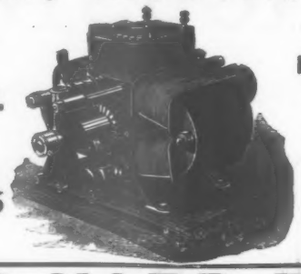

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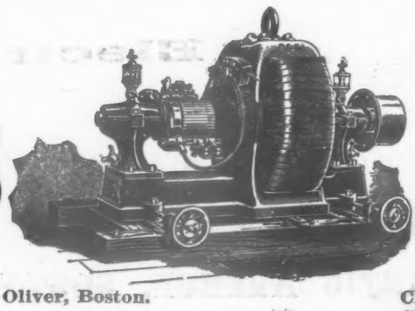

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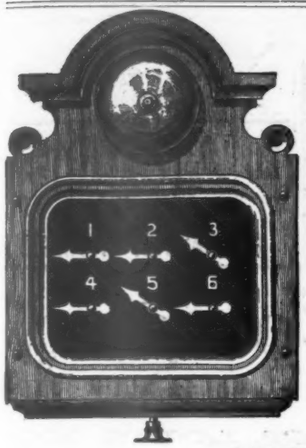

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C	8	.....	.....	.....	6.5	1½	5,000 FEET PER MINUTE.	530
C	.....	10	.....	.....	6.3	1½		530
C	.....	.....	.....	25	8.0	2		590
C	16	.....	.....	.....	12.0	2½		780
C	.....	20	.....	.....	12.5	2½		780
C	.....	.....	28	.....	13.0	2½		780
C	20	.....	.....	.....	15.0	3		990
C	.....	25	.....	.....	15.6	3		990
C	.....	.....	32	.....	15.0	3		990
C	.....	.....	.....	50	16.0	3		990
C	28	.....	.....	.....	21.0	4½		1,360

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Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,400 c. p. 8 amp. Y	No. Lights 1,200 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in inches.	Belt Speed Required.	Weight of Dynamo.
C	.....	35	.....	.....	21.0	4	5,000 FEET PER MINUTE.	1,360
C	.....	.....	45	.....	21.0	4		1,360
C	.....	.....	.....	70	21.0	4½		1,360
H	40	.....	.....	.....	29.7	6		1,750
H	.....	50	.....	.....	30.0	6		1,750
H	.....	.....	64	.....	29.5	6		1,750
H	52	.....	.....	.....	38.0	8		2,290
H	.....	65	.....	.....	38.6	8		2,290
H	.....	.....	83	.....	38.0	8		2,290
K	64	.....	.....	.....	46.5	10		2,770
K	.....	80	.....	.....	47.1	10		2,770
K	75	.....	.....	.....	52.5	12		3,200

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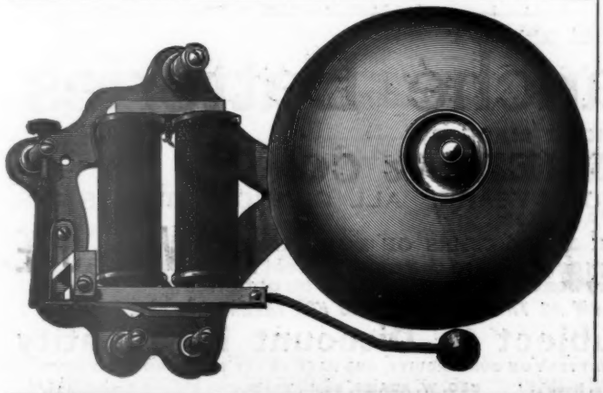

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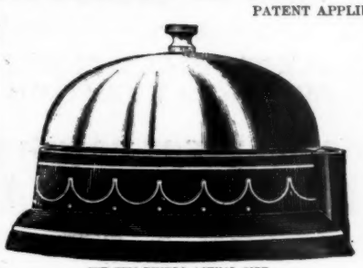

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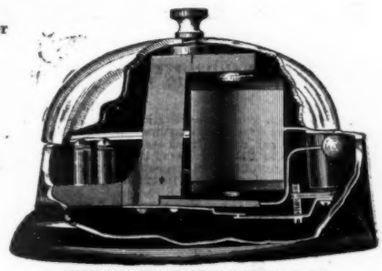

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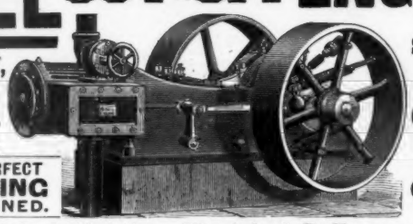

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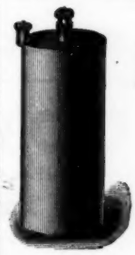

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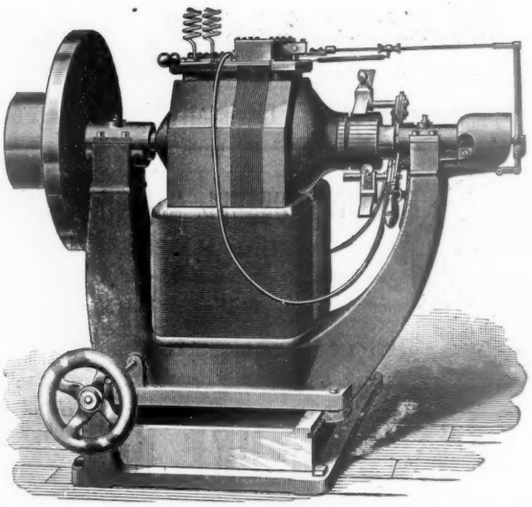

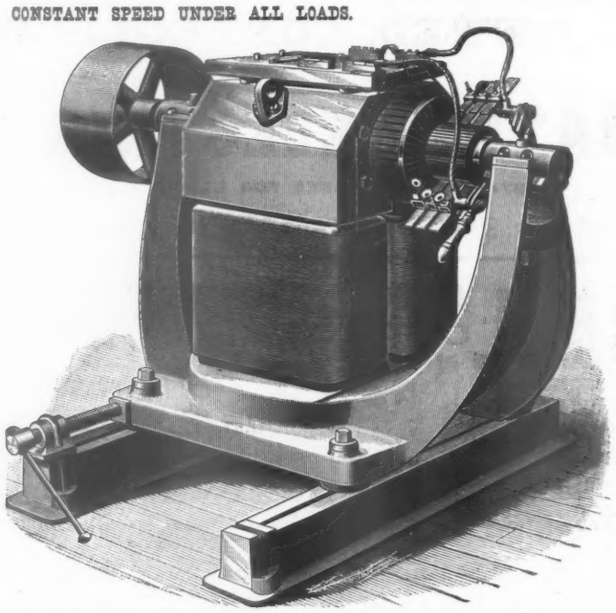

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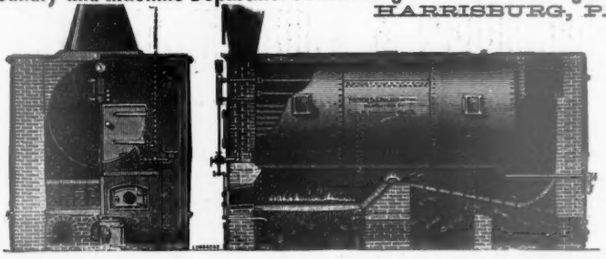

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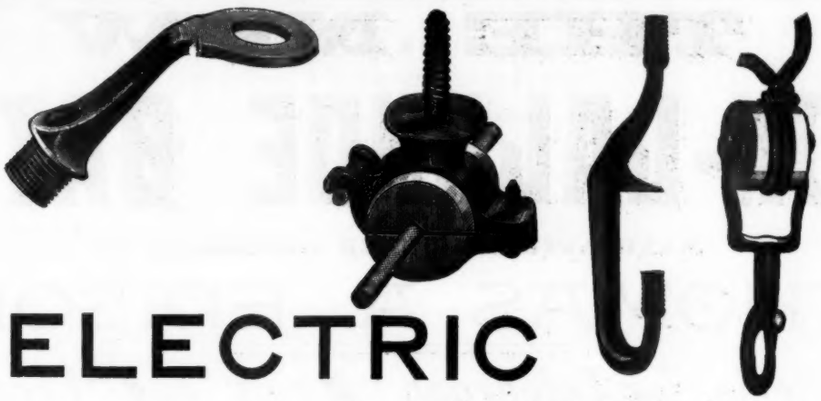

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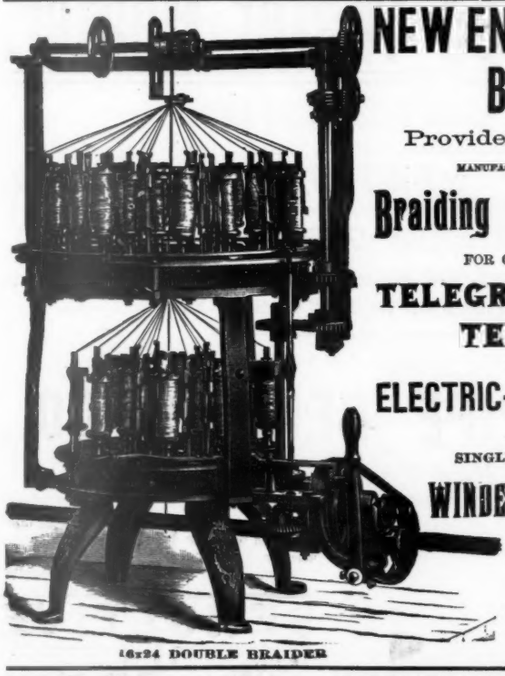

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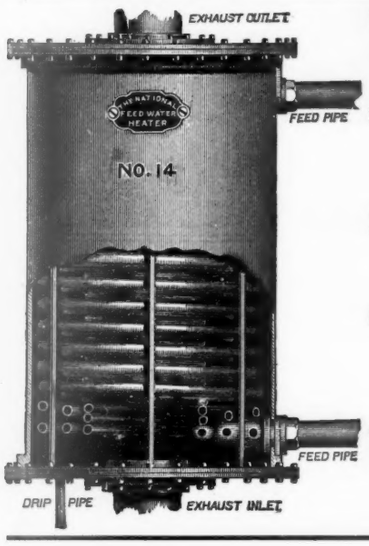

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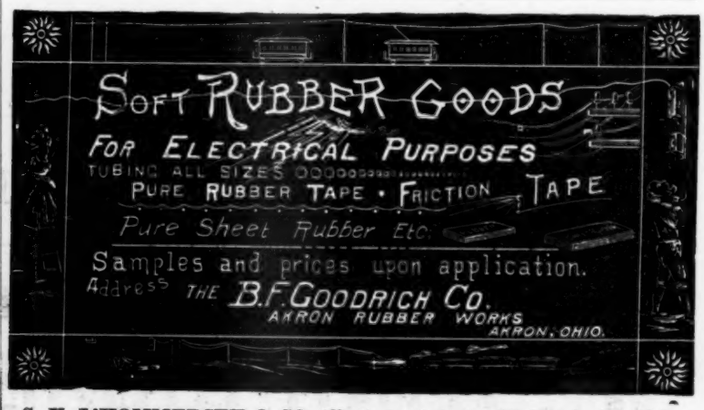

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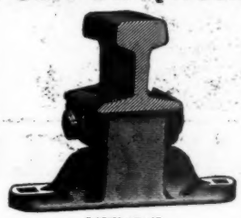
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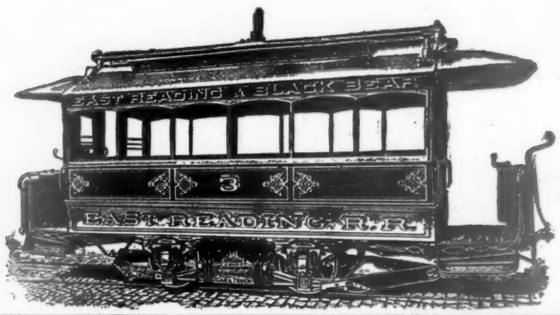

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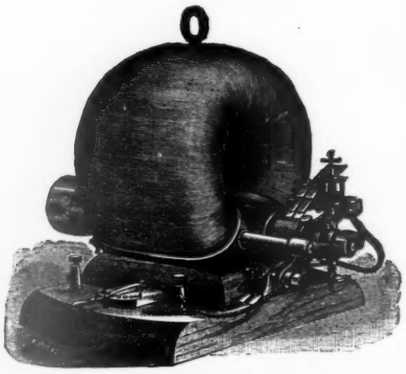

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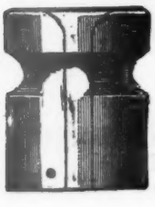

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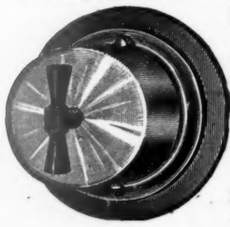

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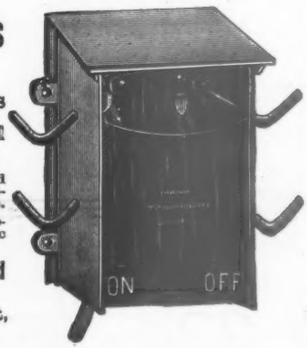

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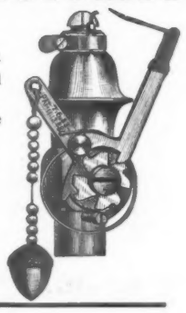

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BRUSH PATENT SUSTAINED.

The broad right to the use of Double Carbon Electric Arc Lamps declared to belong to the Brush Electric Company under U. S. Letters Patent to Charles F. Brush, No. 219,208.

In the suit of the Brush Electric Company vs. the Fort Wayne Electric Light Company, decided at Indianapolis, December 24th, 1889, JUDGE GRESHAM HOLDS:

1. THAT BRUSH WAS THE PIONEER INVENTOR IN COMMERCIAL ARC LIGHTING.

2. THAT THE BRUSH PATENT IN SUIT IS THE PIONEER PATENT FOR DOUBLE CARBON ARC LAMPS.

3. THAT THE PATENT IS BROAD AND FUNDAMENTAL.

4. THAT ALL ITS CLAIMS (SIX IN NUMBER) ARE VALID.

5. THAT THE CLAIMS OF THE PATENT ARE ALL INFRINGED BY THE DEFENDANT.

The Court says: "The separation of the two pair of carbons, so that the arc is established between one pair and maintained between the carbons of that pair until they have been consumed and then automatically established between the carbons of the other pair and maintained between them until they have been consumed, is a dissimultaneous and successive arc-forming separation and it is this feature which distinguishes the lamp in suit from all prior lamps."

The Brush Electric Company is assured by the most competent legal advisers that under this Brush Patent, as interpreted by the U. S. Circuit Court, practically all Double Carbon Electric Arc Lamps now offered for sale are

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and notice is hereby given that infringers, whether manufacturers or users, will be prosecuted and held for damages to the full extent of the Law.

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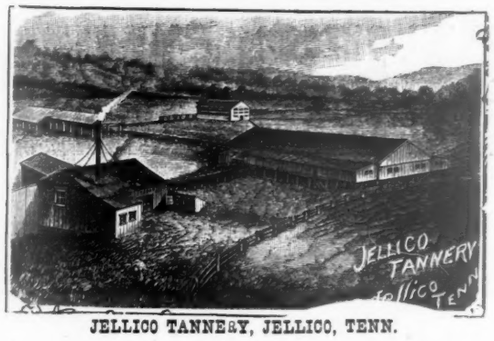

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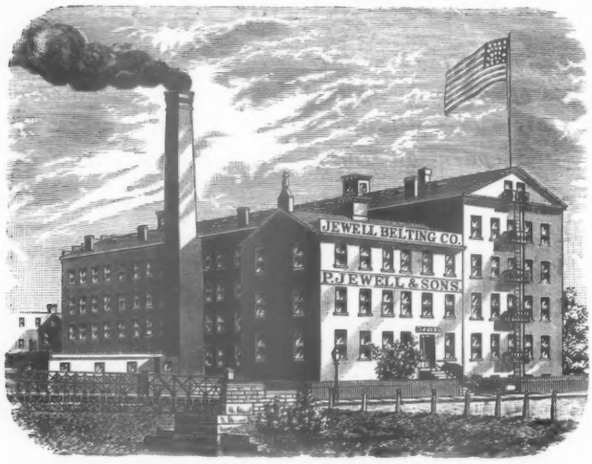

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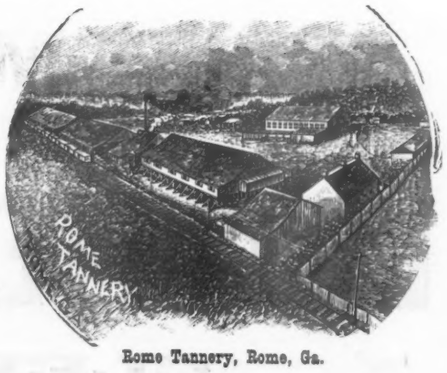

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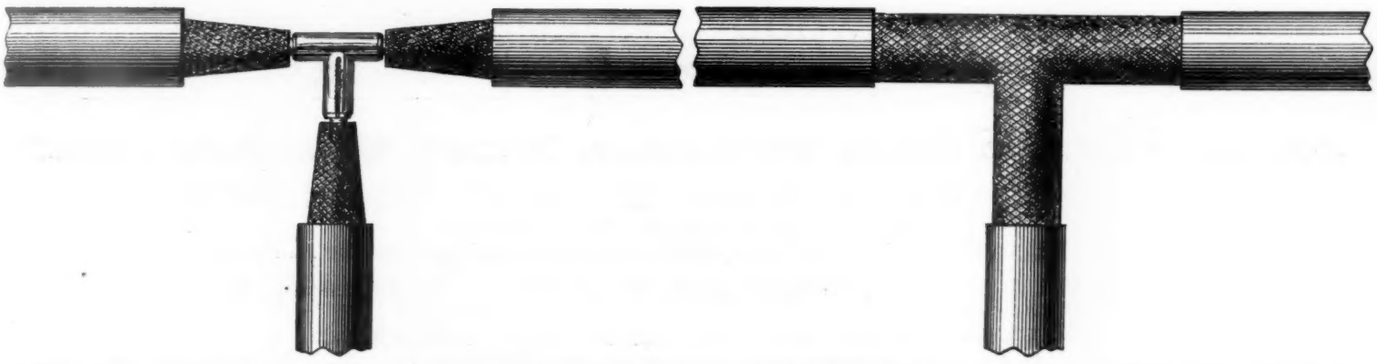

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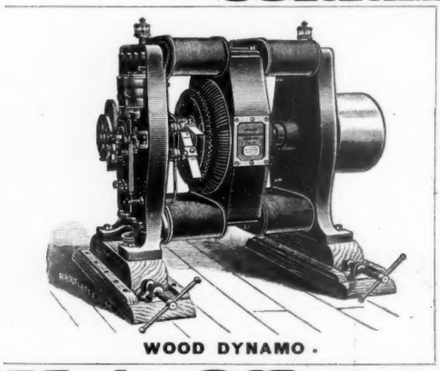

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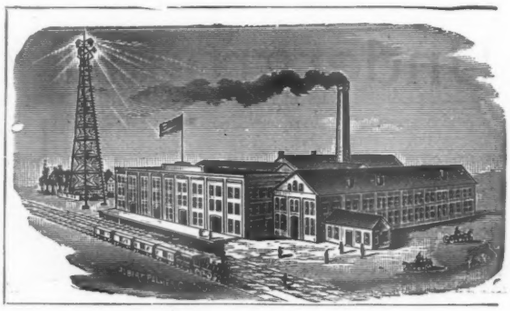

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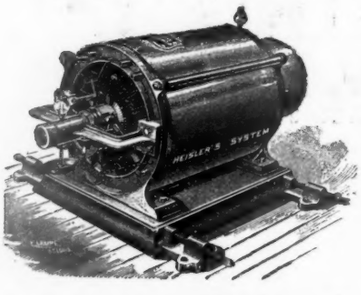

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